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ELECTRICAL WEST

JULY 1961

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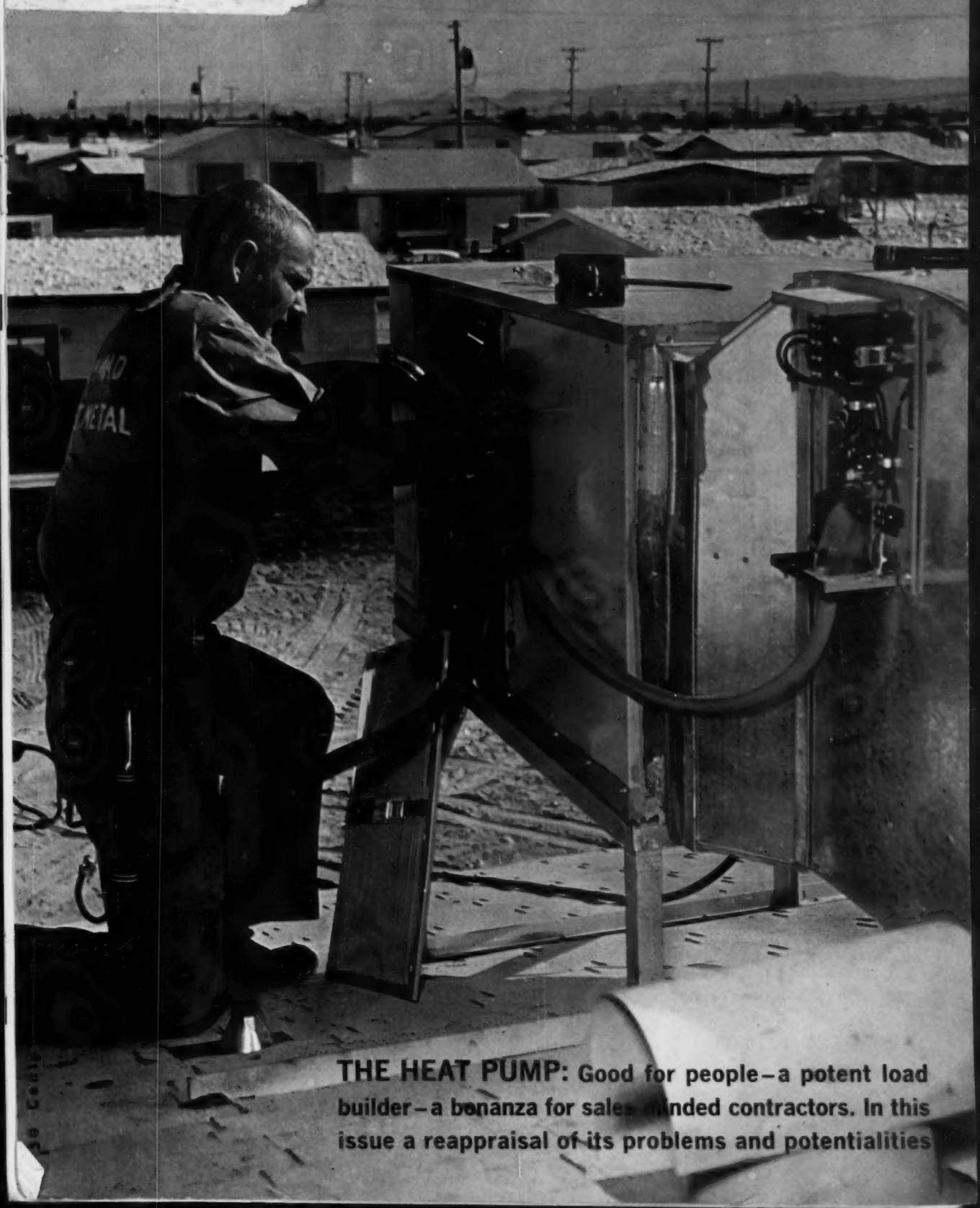


THE HEAT PUMP: Good for people—a potent load builder—a bonanza for sales minded contractors. In this issue a reappraisal of its problems and potentialities

SPLICE and DEADEND

AAC, AAAC AND COPPER . . . WITH

RELIABLE "55" SERIES

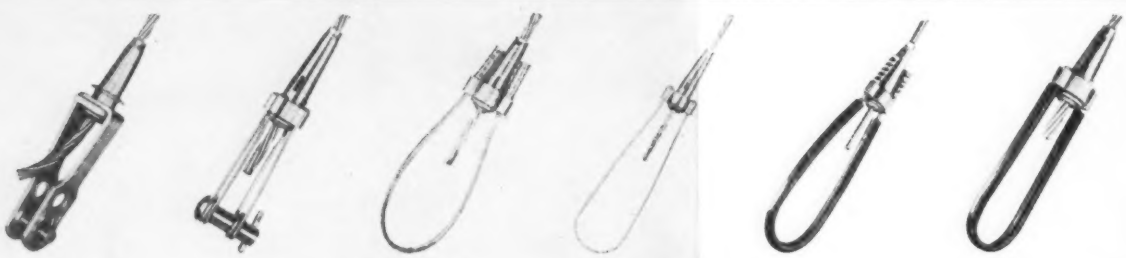
PILOT CUP TYPE

Pilot cup, factory installed in Reliable tension splices, either caps or refuses bent, out-of-lay or burred strand. The chuck cannot engage the conductor until the pilot cup, enclosing strand ends, has been run completely through the chuck. THUS ONLY SOUND CONDUCTOR IS POSITIONED WITHIN THE GRIPPING AREA.

Tensile tests prove the ability of these splices and deadends to hold 100% of the book rated strength of the conductor — AAC, AAAC or copper.

Catalog Number	AAC 7 Strand	AAAC 5005
AL5547	4	5
AL5527	2	3
AL55101	1	2
AL55107	1/0	1
AL55207	2/0	1/0
AL55307	3/0	2/0
AL55407	4/0	3/0
AL55266.8	266.8	4/0

FEED-THRU DEADENDS



"LINES UP"
Reliable's latest movie tells the whole story. Be sure to see it.

During twenty-seven years of continuing production it has never been reported that a Reliable Feed-Thru Deadend chuck let go a line

Reliable

ELECTRIC COMPANY Franklin Park, Illinois

A Symbol of Integrity Since 1909

Why Corporations Anyhow?

The ordinary voter has little conception of the way business has contributed to the advancement of the American standard of living, nor does he realize the importance to his own welfare of preserving the profit and loss system and protecting it against . . . those who, having nothing to lose and everything to gain, would readily change it to further their personal or political ambitions.

HOWARD WOOD, NATION'S BUSINESS

In the last article in this series on the ABCs of the American system, we discussed the importance of the business climate of the companies and corporations that most of us work for. You might ask: "Why do we have corporations, anyhow?" That's a good question. The answer has a very important bearing on the good life that most of us lead under our present system of individual enterprise.

Our standard of living is the result of three things: (1) our natural resources; (2) the tools we use to fashion our natural resources; and (3) how hard we as people apply ourselves to the tools. We are unable to create natural resources—this is God given. We can, however, make the maximum use of nature's bounty through the use of good tools and hard work. To some extent, we have been able to substitute more and better tools for the long hours of drudgery our parents had. A farmer or a factory worker with today's tools can produce more goods in eight hours than their counterparts could have produced a century ago using hand methods. The tools have been the important factor.

Centuries ago men discovered that six men, fishing with a net, could catch a lot more fish than six men fishing separately with a line and a shell hook. So they banded together, wove a net and were able to catch enough fish to feed the whole village rather than just the six families. The net was a "tool" that increased the productivity of each man manyfold and gave the village a lot more fish than it had ever had before. Fish could be sold cheaper because it was much more plentiful. So the fishermen not only made more money but had more time to do other things.

This simple example illustrates two basic facts about our system or any system. All of us can have more if we produce more. We can produce more by working together and using more and better tools.

In today's civilization, the definition of a "tool" is anything that helps us convert our natural resources into usable products. Without tools, we would still be living at the same standard as the cave man.

Thus, tools and the power that runs them become the two most important factors in giving us the abundant life. The word tools covers many things. A tractor is a tool, so is a computer or a generator or a typewriter. Likewise, a railroad train is a tool because it is part of the process of converting distant raw materials into products useful for the city dweller. The supermarket is a tool because it is a final link in a productive chain that makes products directly available to the consumer. In other words, anything that helps man change the form, condition and location of natural resources so these can be used or useful in men's lives may be said to be a tool.

Modern tools cost a lot of money. They wear out, too, and it costs money to replace them. Sometimes new tools are developed that are so much more productive than those in use it becomes prudent to discard the latter even before they are worn out. This takes money too.

As has been discussed in previous articles, the money to get these costly productive tools must come from the savings of the people as a whole. Only a few individuals have enough savings to buy even one modern tool. Therefore, in order to get the large amounts of capital necessary to buy them, it becomes necessary to lump together the savings of many individuals. Thus companies and corporations were formed. They prove the means to get more production and lower costs for all the things that make our lives so pleasant. They also provide us with our jobs and pay with which to buy them.

Resources + Tools + Work = Abundance

We can't increase our resources but . . .

Thomas D. Hanlon of Nevada Power Co. took this picture of a heat pump installation at one of the new housing developments in Las Vegas. With about 60% of the new homes in the area installing heat pumps, Nevada Power probably has the heaviest saturation for its size in the nation. The utility serves some 30,000 residential customers and has 7,000 heat pumps on its lines, more than 2,000 of them installed last year. See Heat Pump report on P 55.

Reprints Available

The ABCs of the American Economy, the series that has been running on page 1 of ELECTRICAL WEST since January, has received wide acclaim. Best of all it is being reprinted by many companies within and without the electrical industry in house organs to get the message down the line to lower echelon employees. There is no cost for using this material from the series but if actual reprints are desired they can be obtained from Northwest Electric Light & Power Assn., 204 Corbett Bldg., Portland 4, Ore., or Pacific Coast Electrical Assn., 530 W. Sixth St., Los Angeles 14, Calif.

The series will continue for another 12 months and later will be reprinted in booklet form.

ELECTRICAL WEST

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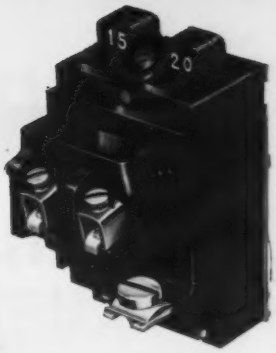
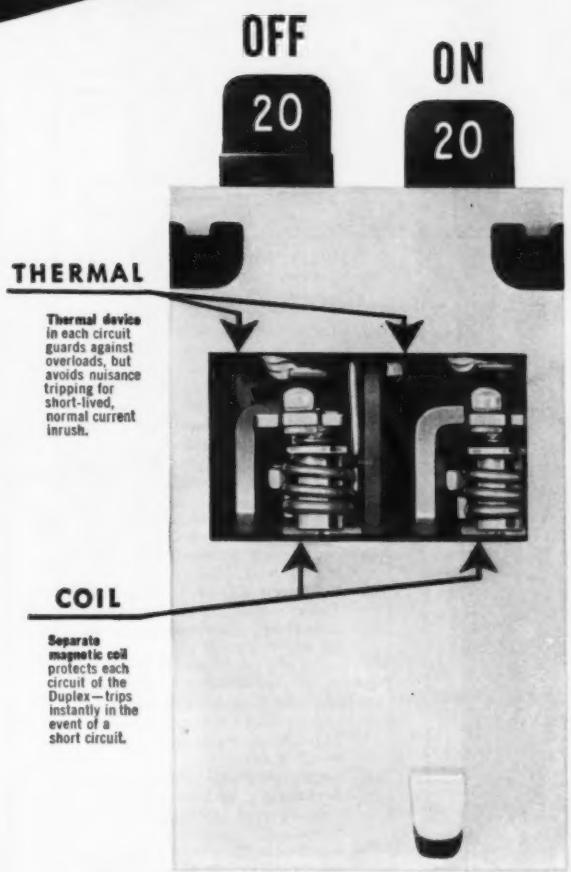
This symbol stands for circuit breaker

This symbol stands for QUALITY

BullDog Duplex Pushmatic—

Still the leader in residential safety and convenience!




OFF
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Thermal device in each circuit guards against overloads, but avoids nuisance tripping for short-lived, normal current inrush.
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Separate magnetic coil protects each circuit of the Duplex—trips instantly in the event of a short circuit.

The leader in safety . . . BullDog's Duplex Pushmatic® circuit breaker provides two protective systems in each circuit. A thermal control teams up with a magnetic coil to assure maximum protection under *any* residential operating condition and to avoid nuisance tripping. Bolted bus-bar connection assures tight, positive contact that prevents overheating. This maximum electrical safety is your best protection against costly trouble calls!

The leader in convenience . . . the Duplex Pushmatic puts two general-purpose circuits, 15 or 20 amps, in the panel space of one—provides maximum circuit flexibility with smaller, less expensive panels. And the Duplex is the *only* breaker with exclusive pushbutton convenience. Also, a tripped breaker can be identified instantly by sight or touch, resets with a push of the finger. For complete details on Pushmatic breakers and panels, write for your "Pushmatic Pocket Guide"—*it's free!*

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Safety Switchboard Company
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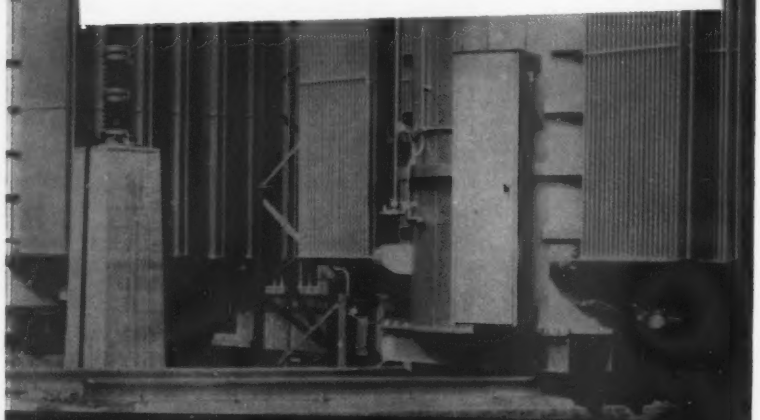
They are easy to apply by brush, spray or roller; and because they are rust-inhibitive, only a single coat is needed to give long-life protection.

Ask for Subox Technical Bulletin No. 7 that shows colors and gives full details. Your local Subox sales engineer can supply a copy, or write direct to the factory.

*Patent Pending



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Meetings Calendar

JULY

4-7—*National Society of Professional Engineers*, 27th annual meeting, Olympic Hotel, Seattle.

6-8—*Electrical Contractors Assn. of B. C.*, 11th annual conference, New Park Hotel, Abbottsford, B. C.

9-14—*Los Angeles Summer Market*, Home Furnishings Mart, Los Angeles.

17-20—*National Association of Electrical Distributors*, Western regional conference, Jack Tar Hotel, San Francisco.

17-21—*San Francisco Summer Market*, Western Merchandise Mart, San Francisco.

18-20—*Western Plant Maintenance Show*, Pan Pacific Auditorium, Los Angeles.

AUGUST

22-25—*Western Electronic Show & Convention*, Cow Palace, San Francisco.

22-25—*American Institute of Electrical Engineers*, Pacific general meeting, Hotel Utah, Salt Lake City.

SEPTEMBER

6-8—*Northwest Public Power Assn.*, Power Use Section, annual meeting, Pacific University Campus, Forest Grove, Ore.

10-13—*Rocky Mountain Electrical League*, annual convention, Jackson Lodge, Wyo.

11-13—*International Association of Electrical Inspectors*, Northwestern Section, Owyhee Hotel, Boise, Idaho.

17-20—*National Association of Electrical Distributors*, Western regional conference, Jack Tar Hotel, San Francisco.

17-21—*IAEI*, Southwestern Section, Hotel del Coronado, Coronado.

20-21—*Electric Companies Public Information Program*, workshop conference, Brown Palace Hotel, Denver, Colo.

20-22—*Northwest Electric Light & Power Assn.*, 54th annual meeting, Sheraton-Portland Hotel, Portland.

OCTOBER

3-5—*Electric League of Southern California*, Lighting Progress Exposition, Palladium, Hollywood, Calif.

5-6—*Northwest Public Power Assn.*, Accounting and Finance Section, annual meeting, Everett, Wash.

16-18—*Northwest Electric Light & Power Assn.*, Business Development Section, Davenport Hotel, Spokane.

26-27—*Pacific Coast Electrical Assn.*, Hawaiian conference, Princess Kaiulani Hotel, Honolulu.

NOVEMBER

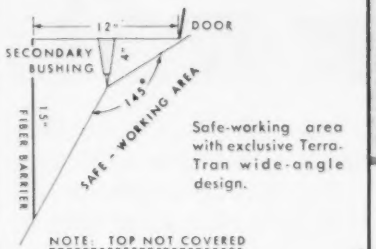
24-29—*Electrical & Home Appliance Show*, Balboa Park, San Diego.

27-28—*Pacific Coast Electrical Assn.*, Administrative Services Section, fall conference, Miramar Hotel, Santa Barbara, Calif.

Terra-Tran® WIDE-ANGLE DOORS

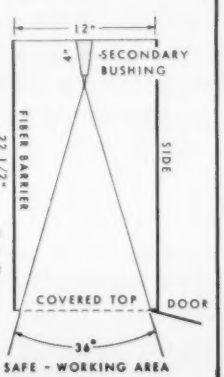
give a man elbow room...

Make the wide-angle design comparison:



Safe-working area with exclusive Terra-Tran wide-angle design.

NOTE: TOP NOT COVERED



Safe-working area with typical separable compartment transformer.

RT&E Terra-Tran doors have 145° wide-angle design... 4 times more safe-working area for servicemen. Up-front, less than 12 inches away, primary and secondary terminations are within easy reach... no top or sides to box in the working area. In the Terra-Tran wide-angle design as many as 36 secondary leads can be hooked up with greater ease and safety because servicemen are not hampered by limited, tight, working space.

Changeout with Terra-Tran is simpler ... remove only 4 mounting bolts and slide away smaller Terra-Tran — slide in the new with the doors wide open. Remember Terra-Trans weigh much less, too.

RT&E builds a world of safety in the Terra-Tran

Only RT&E Terra-Trans have:

- 145° wide-angle door design
- 4 times more safe-working area
- No top or sides to hamper servicemen
- Up-front primary and secondary terminations within easy reach

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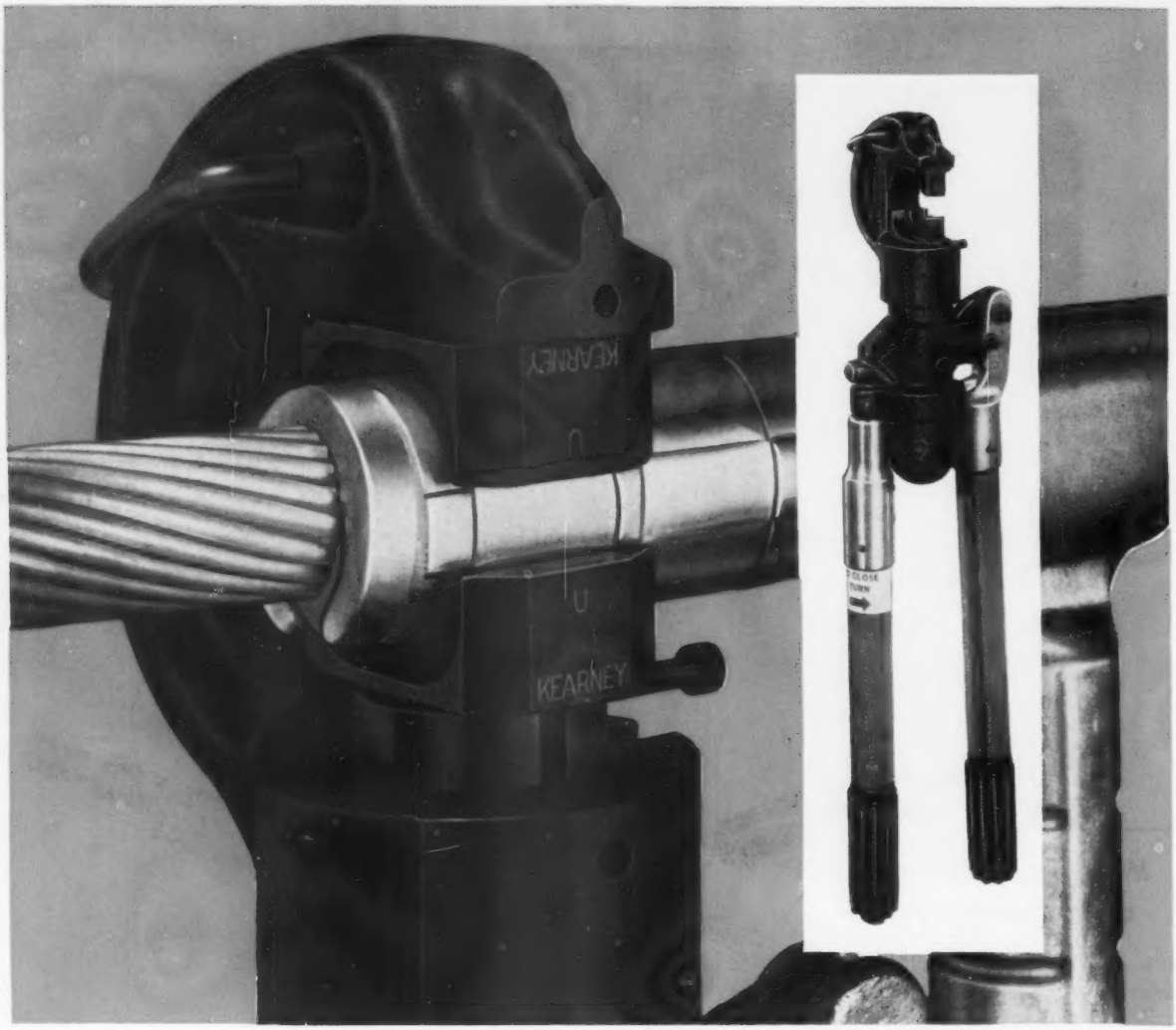
KEARNEY WH-2 HYDRAULIC TOOL AND



This is the tool... Kearney does it again! The Kearney WH-2 Hydraulic Tool—big brother to the WH-1 Tool—is the FIRST and ONLY portable, hand-operated, hot-line compression tool to accommodate such a wide range of fitting and conductor sizes. Equipped with only this ONE tool linemen can now install tap compression connectors on all sizes of energized and non-energized conductors from #6 Solid through 636 MCM ACSR! Die sizes are the same as those for the Kearney WH-1 Tool, plus the additional sizes required to install the larger fittings shown on the opposite page. Dies snap in or out easily . . . can be secured with a set-screw. A two-step, high speed pump generates full 21,000 pounds of thrust. An automatic overload valve prevents over-compression. Large C-frame head allows clear view of work area while making indents. A partial rotation of one handle sets tool to compress or retract dies—no need to remove either hand from handles. Interchangeable insulated handles are available in various lengths to adapt tool to individual voltage requirements.

In the West: For further information, contact your Kearney West Coast Distributor
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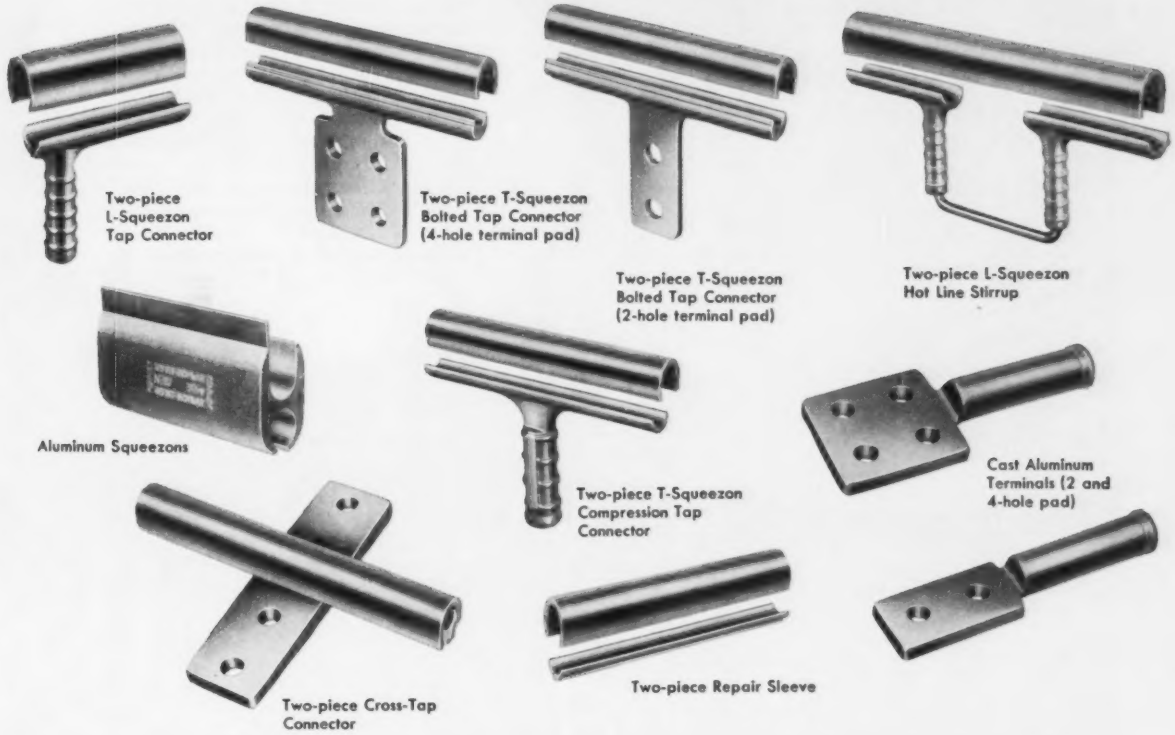
2-PIECE COMPRESSION CONNECTORS

. . . extend the connection range to include installations on all "Hot" or "Cold" lines from #6 Solid to 636 MCM ACSR


Two-piece L-Squeezon Tap Connector
Two-piece T-Squeezon Bolted Tap Connector (4-hole terminal pad)
Two-piece T-Squeezon Bolted Tap Connector (2-hole terminal pad)
Two-piece L-Squeezon Hot Line Stirrup
Aluminum Squeezons
Two-piece T-Squeezon Compression Tap Connector
Cast Aluminum Terminals (2 and 4-hole pad)
Two-piece Cross-Tap Connector
Two-piece Repair Sleeve

These are the fittings... New, larger Kearney tap connectors and the Kearney WH-2 Hydraulic Tool now extend the tap compression connection range to include installations of highest electrical efficiency on energized or non-energized conductors as large as 636 MCM ACSR. Kearney two-piece aluminum tap connectors accommodate large conductor sizes from 266.8 MCM through 636 MCM ACSR. Tap units slide into and interlock with an encircling sleeve unit. Sleeve for any one conductor size will accept interchangeably various tap units of the same size range. Kearney interlock design aids installation . . . insures uniform compression and full-circumference contact . . . eliminates strand cutting. Sufficient connector mass without excess weight assures cool-running connections. Interchangeability of tap units helps reduce storekeeper inventories.

Also illustrated: Kearney Cast Aluminum Terminals, accommodating wire sizes from #2 ACSR to 1000 MCM Str.; Aluminum Squeezons for wire sizes from #6 Solid to 397.5, line or tap.

KEARNEY

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KERITE? Certainly we are in favor of using it. It has saved us thousands of dollars over the years by preventing service failures and all the problems that can come from them. In their specialized fields The Kerite Company has pioneered more cable designs than anyone else and has in fact influenced the techniques of the entire wire and cable industry. We need them and they deserve our support. Furthermore they stand back of their product no matter what the circumstances.

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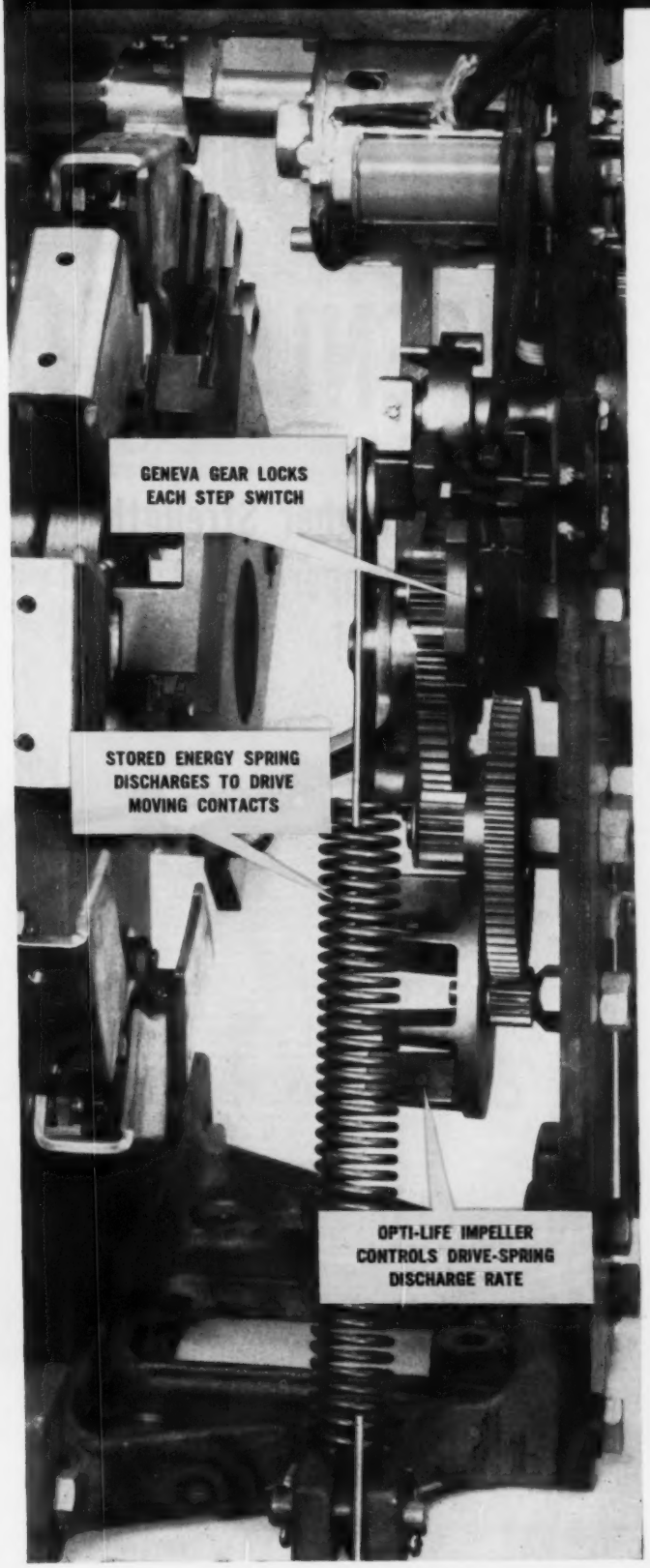
ANOTHER STEP AHEAD IN VOLTAGE REGULATION


GENEVA GEAR LOCKS EACH STEP SWITCH
STORED ENERGY SPRING DISCHARGES TO DRIVE MOVING CONTACTS
OPTI-LIFE IMPELLER CONTROLS DRIVE-SPRING DISCHARGE RATE

CONTROLLED REGULATOR SWITCHING SPEED

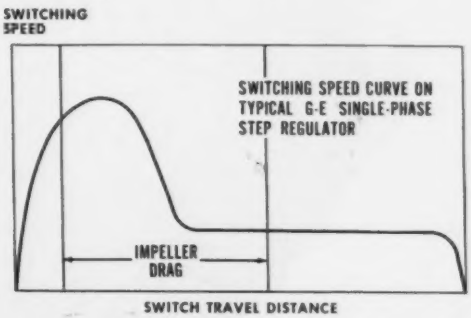
General Electric voltage regulator switches operate 20 years without inspection . . . give you maximum contact life

As regulator users know, there is an optimum tap-changing speed for maximum contact life. Optimum speed must be *controlled* and *non-linear*.

General Electric's exclusive Opti-life switch satisfies these requirements. Results: contacts "break" fast to reduce arcing. Contacts "make" at a calculated rate to (1) reduce mechanical abrasion of contacts, and (2) reduce arcing from contact "bounce."

Truly *controlled* speed of General Electric Opti-life switches is achieved by a fast-action drive, *plus* an oil-immersed impeller which dampens switch velocity as contacts close.

Benefits to you: maximum contact life. In fact, it *isn't necessary to periodically inspect* the interior of a General Electric ML-32 regulator. Under normal operation, switch inspection shouldn't be necessary *for at least 20 years*. You save money!


SWITCHING SPEED
SWITCHING SPEED CURVE ON TYPICAL G-E SINGLE-PHASE STEP REGULATOR
IMPELLER DRAG
SWITCH TRAVEL DISTANCE

FOR MORE REASONS WHY G-E regulators cost less on the line—see your General Electric regulator representative. Or, write General Electric Company, Section 456-05, Schenectady 5, N. Y. *Voltage Regulator Product Section, Pittsfield, Mass.*

Progress Is Our Most Important Product

GENERAL ELECTRIC

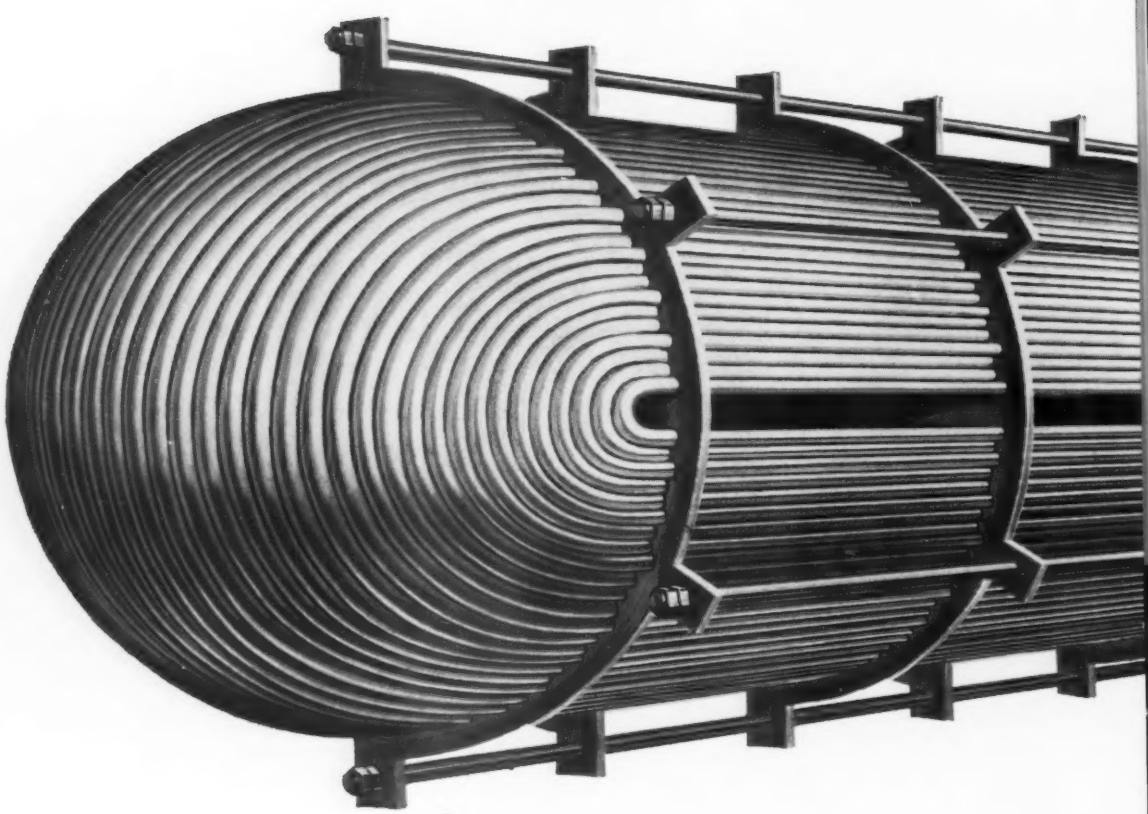
For phone number of closest representative see advertising index in back of book.

Another New Extra High Strength
Condenser Tube Developed by

PHELPS DODGE!

CUFENLOY-40

With 15% Higher Strength than
any other Copper-Nickel Alloy
Now Available!



In August 1959, Phelps Dodge introduced the first high strength copper-nickel alloy condenser tube, Cufenloy-30. Now Phelps Dodge offers Cufenloy-40, a copper-nickel alloy with greatly increased strength suitable for the most severe applications in high pressure feedwater heaters. The mechanical and physical properties of this exclusive new alloy make possible substantial reductions in the cost of feedwater heaters. Cufenloy-40 has received approval for ASME Code applications through Case 1300 (Special Ruling).

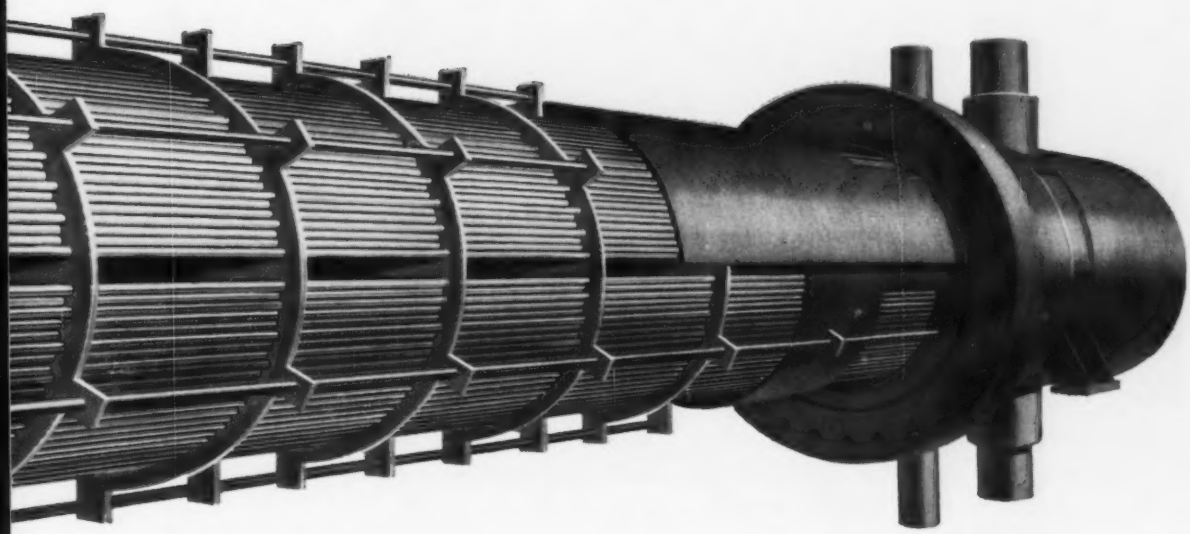
Weldability. Extensive tests in Phelps Dodge's laboratories were performed to determine Cufenloy-40's welding characteristics. Standard welding procedures used for 70/30 copper nickel tubes were found to be fully acceptable for this new composition. Pull-out, Cycling and Pressure Tests confirmed that a maximum joint efficiency was obtained using these procedures.

Corrosion Resistance. Corrosion studies have been performed on Cufenloy-40 since 1959 and have shown it to be unsusceptible to stress corrosion cracking in a moist ammonia and carbon dioxide atmosphere. In these tests Cufenloy-40 also proved virtually immune to general chemical attack. It is believed that Cufenloy-40 has the best overall corrosion resistance of the copper-nickel alloys.

Dual Gauge. Cufenloy-40 condenser tubes are available in dual gauges wherever a thickened wall section is needed to compensate for thinning on tight radius bends.

U-Bent Tubes. Cufenloy-40 tubes are also furnished in factory "U" bends for immediate tubing into the unit at the manufacturer's plant or on the job site.

Further Information from your local Phelps Dodge sales office, or write Dept. 2D for the Cufenloy-40 technical brochure.



PHELPS DODGE COPPER PRODUCTS
CORPORATION
300 Park Avenue, New York 22, N.Y.

P MINE TO MARKET D

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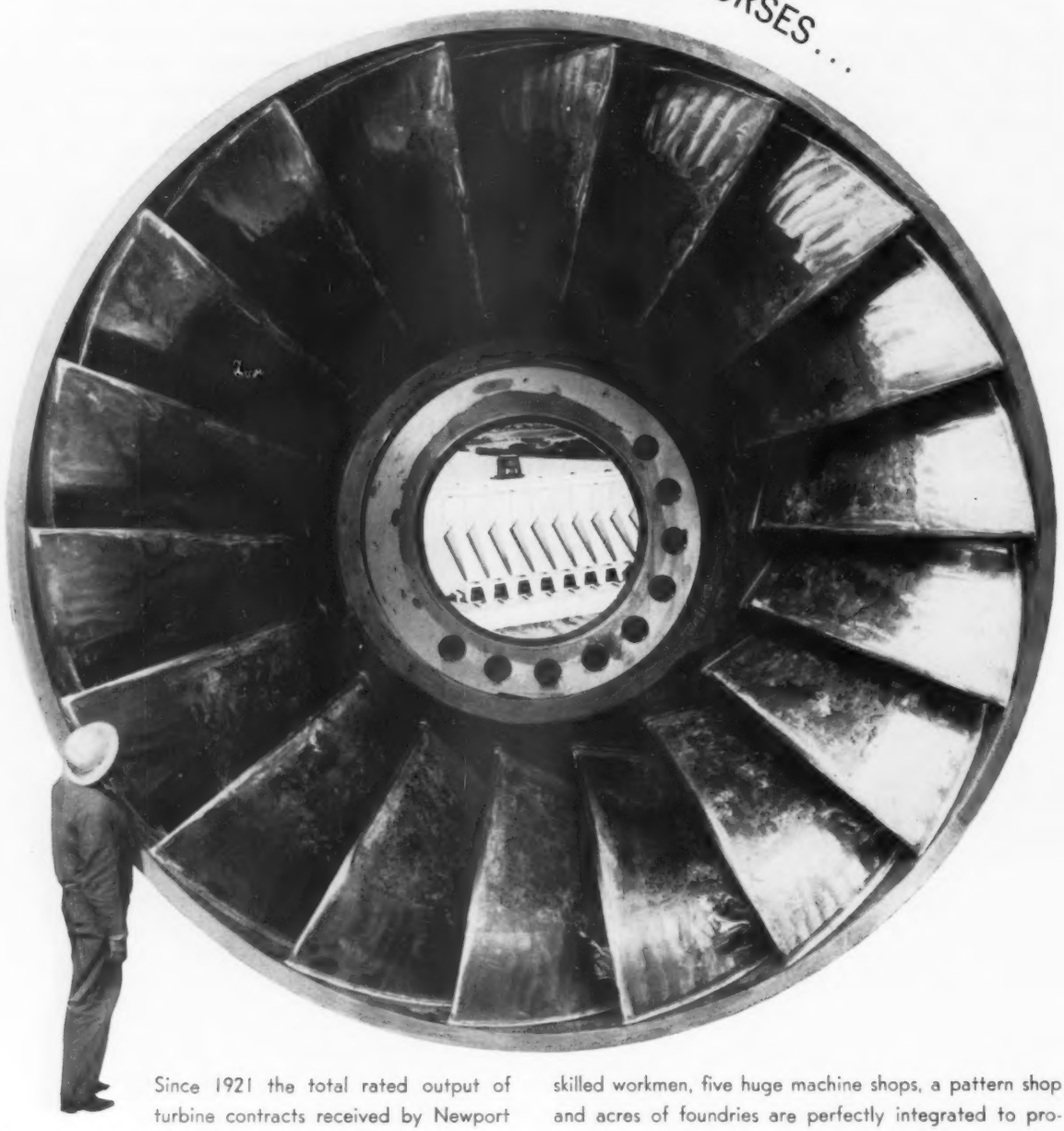
NEWPORT NEWS HARNESSES 12,000,000 HORSES...



Since 1921 the total rated output of turbine contracts received by Newport News exceeds 12,000,000 horsepower. The Niagara Project, Grand Coulee, Hoover and Chief Joseph are but a few of the installations for which Newport News has designed and built such equipment as hydraulic turbines, valves, gates and penstocks.

Newport News has the men . . . the methods . . . and the machines to take gigantic jobs like these in stride. Large engineering and design staffs, hundreds of highly skilled workmen, five huge machine shops, a pattern shop and acres of foundries are perfectly integrated to produce large units in the shortest possible time . . . from water power equipment to wind tunnels, from cracking towers to paper dryer rolls.

Look to Newport News with its seventy-five years of metal fabricating experience. Your inquiries are invited.

Newport News
SHIPBUILDING AND DRY DOCK CO.
NEWPORT NEWS, VIRGINIA

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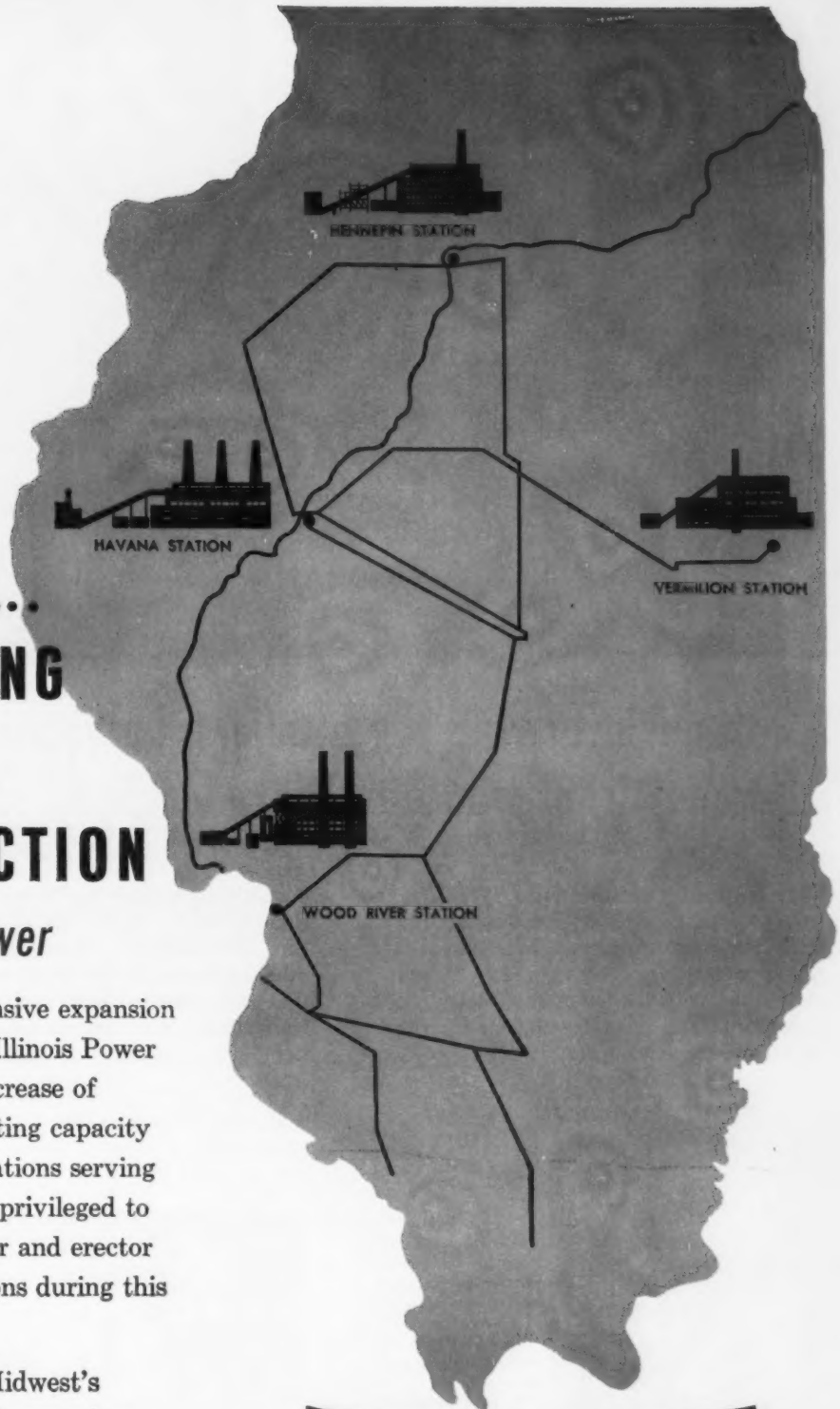


14 YEARS... CONTINUING PIPING CONSTRUCTION

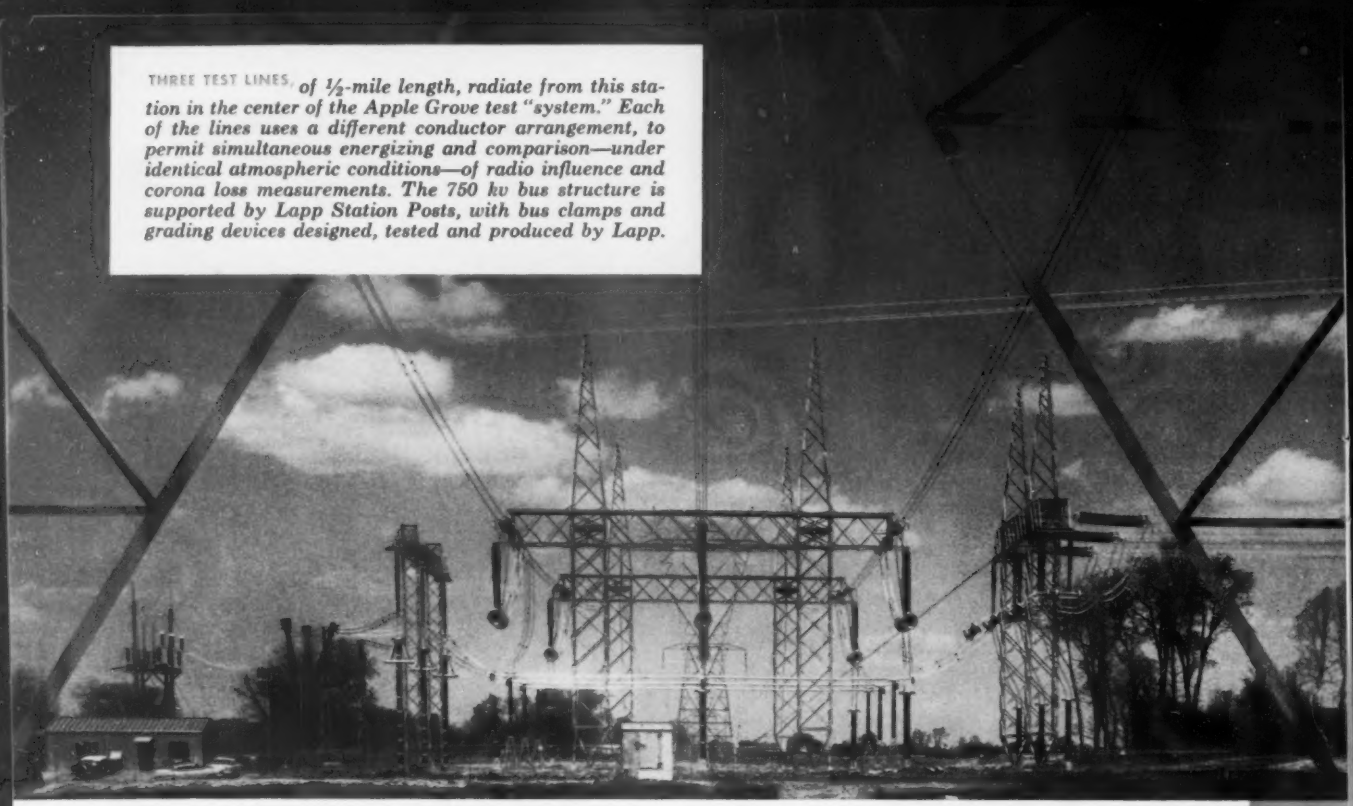
for Illinois Power

A 14-year era of extensive expansion has been enjoyed by Illinois Power Company, with an increase of 1,092,000 KW generating capacity shared by the four stations serving the state. Midwest is privileged to have been the supplier and erector of piping for all stations during this expansion program.

For information on Midwest's complete piping erection services for power stations and industrial processing plants, write today for 24-page illustrated brochure POWER AND PROCESS PIPING. 6119

MIDWEST PIPING

A Division of Crane Co. 1450 South Second St. • St. Louis 4, Missouri

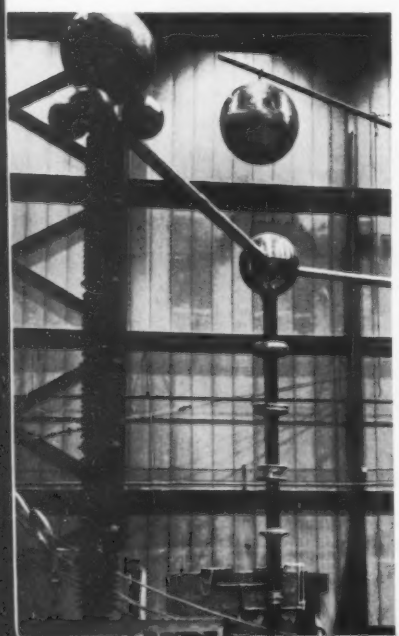


THREE TEST LINES, *of ½-mile length, radiate from this station in the center of the Apple Grove test "system." Each of the lines uses a different conductor arrangement, to permit simultaneous energizing and comparison—under identical atmospheric conditions—of radio influence and corona loss measurements. The 750 kv bus structure is supported by Lapp Station Posts, with bus clamps and grading devices designed, tested and produced by Lapp.*

"... to push forward the frontiers, both technical and economic, of transmission to levels up to 750 kv"

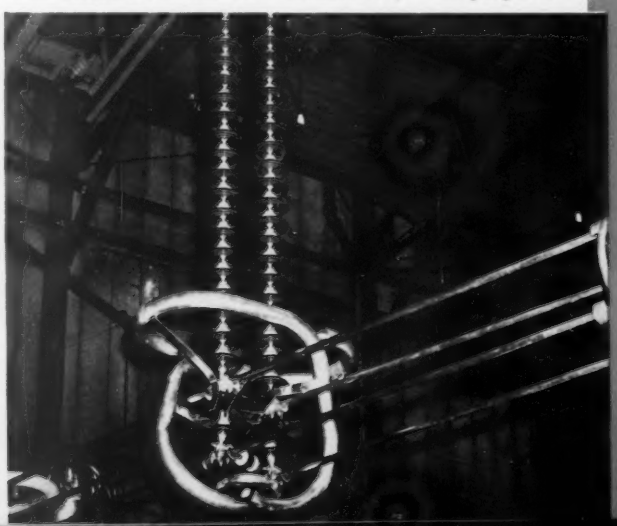
—Philip Sporn, March 28, 1960

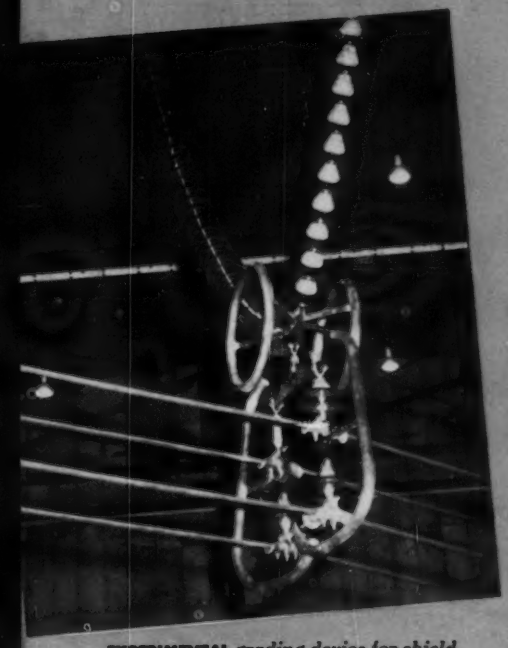
On June 22, 1961, the Governor of West Virginia closed the switch, the lines were energized, and a three-to-five year testing program of transmission at 750 kv was begun, co-sponsored by American Electric Power Service Corp. and Westinghouse Electric Corp. Lapp Insulator Co., one of six other manufacturers participating, is proud to have been able to contribute its technical and production facilities to the design, testing and manufacture of insulators, corona control devices and other hardware for this project. As a result, Lapp is now qualified to supply such material, of known characteristics, for transmission line and substation use at any presently-contemplated EHV.



TEST *(left) of 6" IPS tubular conductor for corona-RIV characteristics. A series of such tests conducted in the John Lapp High Voltage Laboratory on bundled conductors, cable splices, clamps, T-taps and jumper fittings provided important data for the Apple Grove project.*

GRADING DEVICE *(below) for suspension point of four-bundled conductor. Novel configuration provides effective shielding in a compact, easily assembled, economical design. The small insulators isolate lower conductors, for test purposes.*

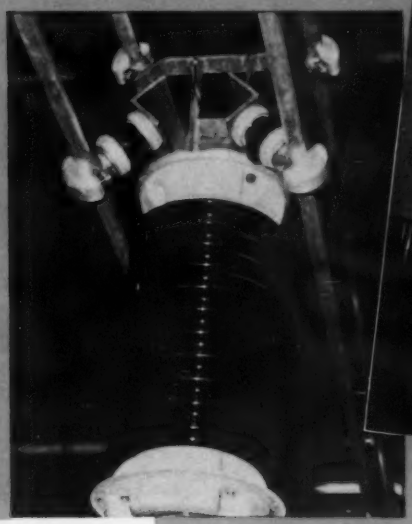


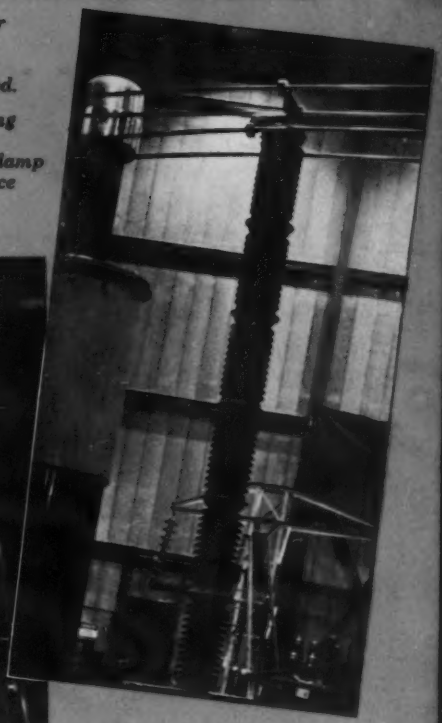


EXPERIMENTAL *grading device for shielding V-string suspension assemblies. This design was later abandoned in favor of a more simple configuration.*

2100 BIL *Station Post support (right) for four conductor bundle. Clamp assembly utilizes field surrounding bus to shield insulator—no additional grading required.*

Closeup (below) shows method of nesting bundled conductor around head of Station Post insulator. Sharp edges on clamp spacers within the bundle do not produce radio noise. Small 5 kv Posts isolate the lower conductors for test purposes.





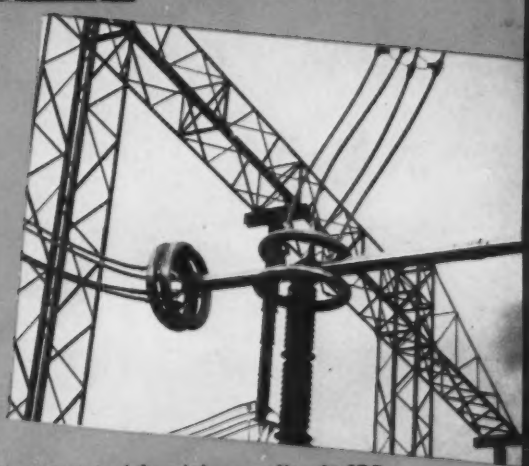
LAPP'S PART

in Apple Grove Test Project

TRANSMISSION: Insulators, clamps and grading devices for one of the lines—designed, tested, and supplied.

STATION: 2100 BIL Station Post insulators, bus clamps, grading devices, and transition devices for connecting rigid bus to flexible four-bundled bus—designed, tested, and supplied.

LABORATORY TESTING of bus, clamps, couplings, connectors, cable splices, dead-end clamps, T-taps, and jumper fittings.



TRANSITION DEVICE *(above) for coupling 6" IPS tubular conductor to flexible bundled conductor, shielded with double ring assembly on left. Grading ring assembly on top of Station Post shields both the insulator and the 4-bundled flexible tap.*

INDOOR, *metal-shielded, light-proof laboratory (below) houses facilities for 60-cycle testing to 1,050,000 volts . . . impulse generation to 2,250,000 volts . . . high-current testing to 10,000 amps . . . and RIV measurement at voltages across the specimen to 600 kv. Here Lapp engineers designed and tested grading devices, clamps and other hardware now in service at the 750 kv Apple Grove test project site.*

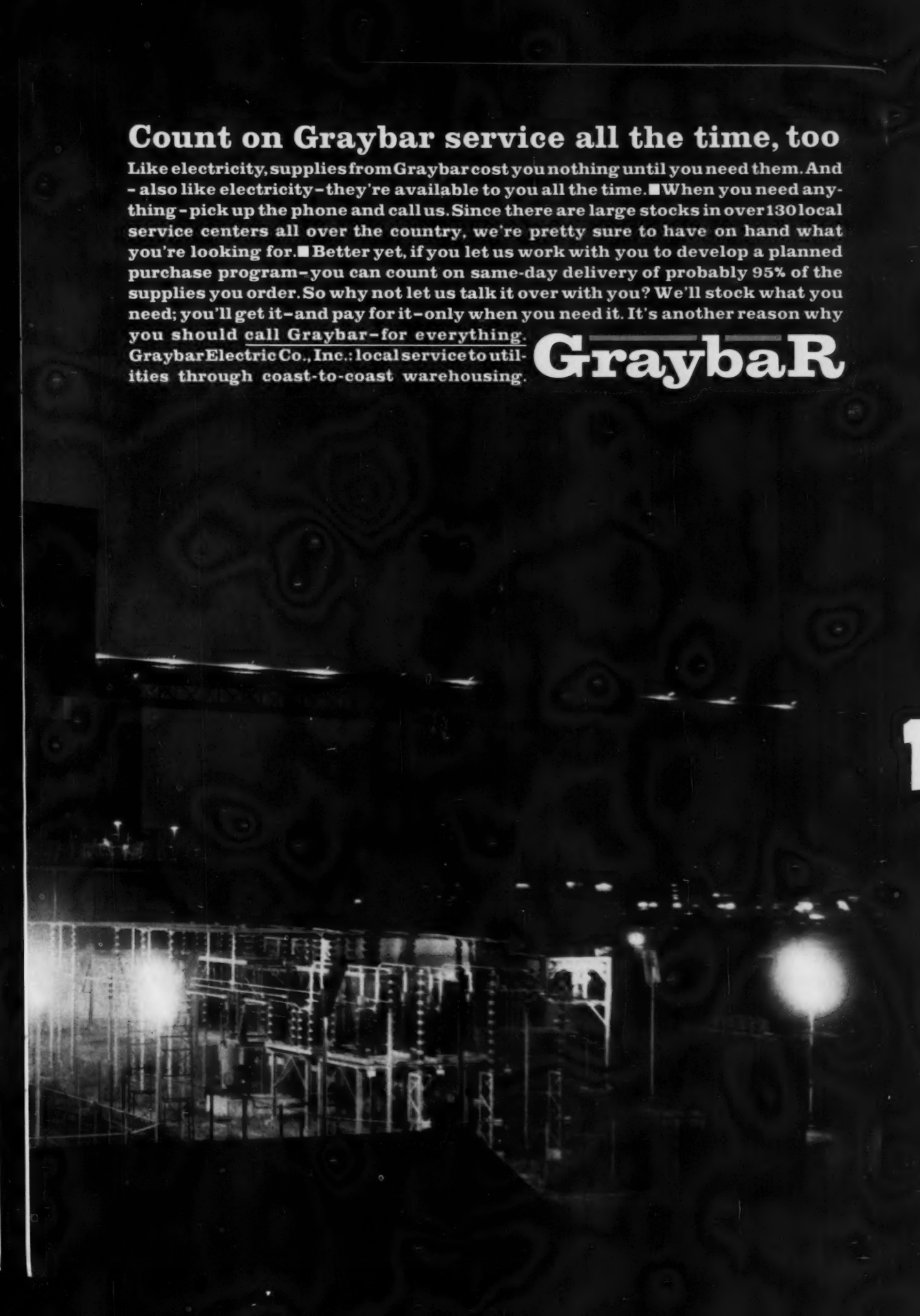
Lapp

Count on Graybar service all the time, too

Like electricity, supplies from Graybar cost you nothing until you need them. And - also like electricity - they're available to you all the time. ■ When you need anything - pick up the phone and call us. Since there are large stocks in over 130 local service centers all over the country, we're pretty sure to have on hand what you're looking for. ■ Better yet, if you let us work with you to develop a planned purchase program - you can count on same-day delivery of probably 95% of the supplies you order. So why not let us talk it over with you? We'll stock what you need; you'll get it - and pay for it - only when you need it. It's another reason why you should call Graybar - for everything.

Graybar Electric Co., Inc.: local service to utilities through coast-to-coast warehousing.

GraybaR



the amazing heat pump

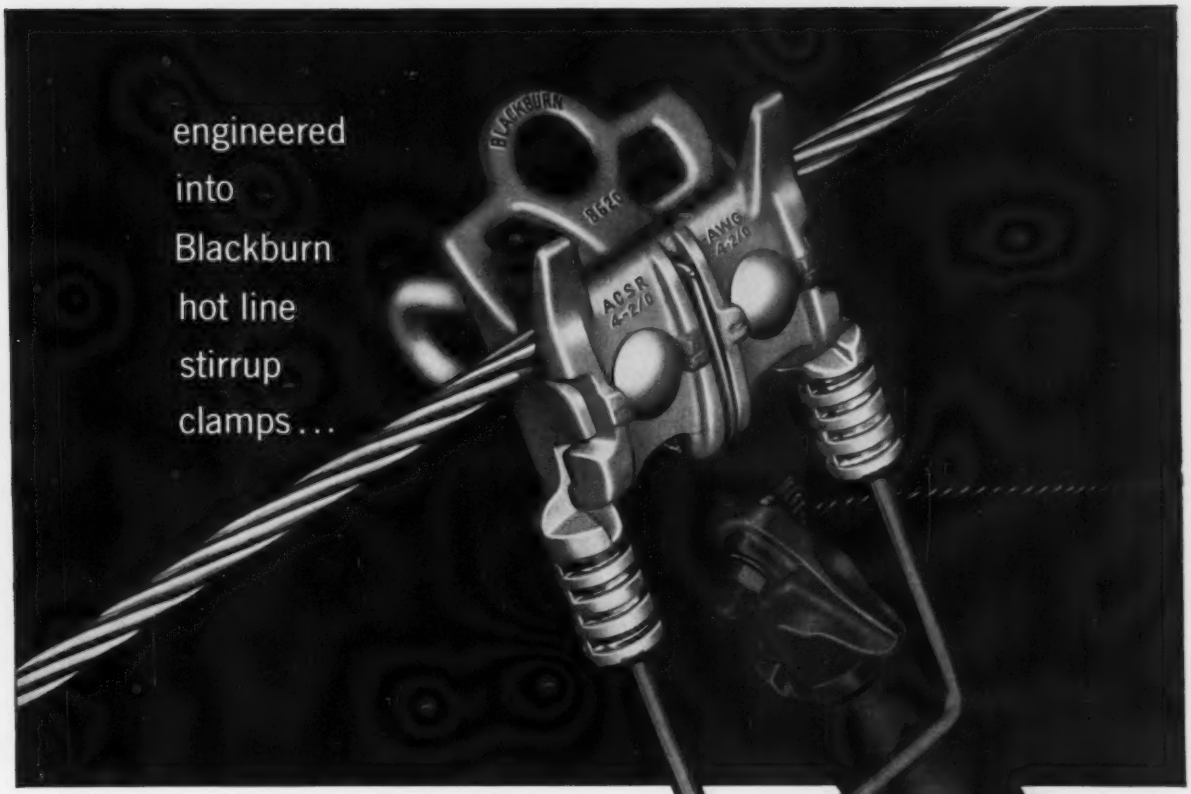
Facts about a single unit that heats and cools!

As a fresh idea for year-round comfort, the Heat Pump is proving successful in business and homes everywhere. The reason for this popularity: a remarkable concept in temperature control! **HOW IT WORKS:** Thermostatically regulated, the Heat Pump cools when the temperature inside the building rises above a pre-set degree—a refrigerant collects heat from indoors and releases it outside. When the temperature falls below the setting, the Heat Pump simply reverses itself—the refrigerant absorbs heat from outdoors, and transfers it inside. It's all done automatically and electrically. **WHAT IT DOES:** The Heat Pump guards indoor temperature so that it never varies more than 4 degrees. At the same time, dust, pollens and excessive moisture are removed from the inside air. One setting of a dial gives complete climate control—365 days a year! **HOW IT'S USED:** As a central system, the Heat Pump is especially efficient, and practical for installation when either building or remodeling. Individual room units are also available in window, wall or roof models...these require less duct work and permit maximum "zone-control" (one room can be cooled while another is heated). For more information, ask an air conditioning dealer or call your local PG&E office.

PG&E Service is your best bargain

P·G and E·

Pacific Gas and Electric Company



patent applied for

PROTECTION AGAINST MAIN LINE DAMAGE

Blackburn SC series clamps offer an effective way to protect main conductors against damage from hot line taps without the use of armor rod. Tap is made on extended bail . . . not on the main conductor.

High clamping force of massive clamp is maintained over large contact area, making a low resistance, cool operating main line connection. A low resistance, balanced current path is fed to the bail from both legs of the clamp. The bail is mechanically bonded to the clamp body with interlocked tubular compression sealed joints.

Castings are of high strength, non-copper bearing aluminum alloy. Clamps may be used on either aluminum or copper mains. When used on copper it is necessary to order prefilled with Contax, a highly efficient inhibiting paste. Bails are provided in bare copper, tin plated copper or aluminum. All bails are available straight or with a 45° offset.

Blackburn stirrup clamps are easily installed hot or cold. Hex nuts or eye nuts (that fit all shotgun sticks) are available. A permanent steel spring secured to the body of the clamp imparts a strong snap grip on the interlocking jaws, supporting the clamp on the main while bolts are being tightened. Only two clamps cover a main wire range from No. 4 AWG through 397.5 ACSR.

For complete information, write for catalog data sheet and samples.

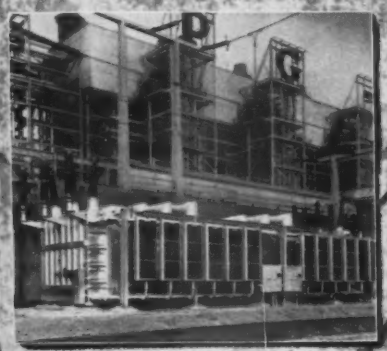
Jasper
BLACKBURN
Corporation

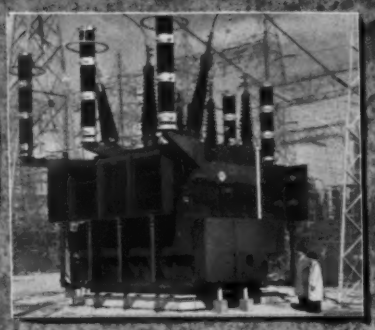
1525 Woodson Road • Saint Louis 14, Missouri

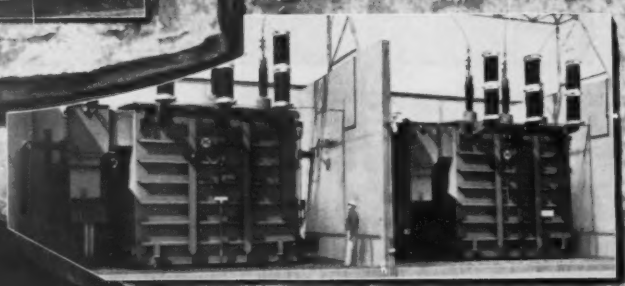
For phone number of closest representative see advertising index in back of book.

MIDWEST — Wisconsin Electric Power Company's Blue Mound Station, Milwaukee, Wisconsin, takes advantage of both dual-cooling and low ambient temperatures to carry projected peak loads — 460 mva — during an outage of one transformer.

WEST — Pacific Gas & Electric Company's Pittsburg, California, station uses DUAL COOLED transformers. In the event one transformer is off the line, Allis-Chalmers dual-cooling permits the remaining transformer to carry two-thirds of the turbine output.

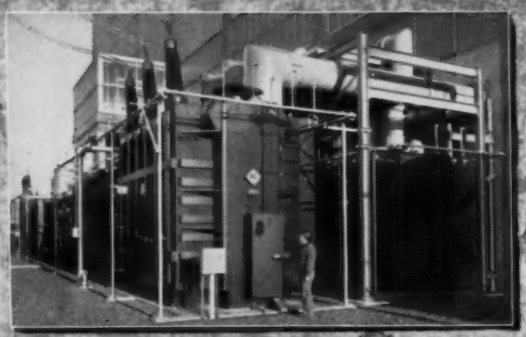




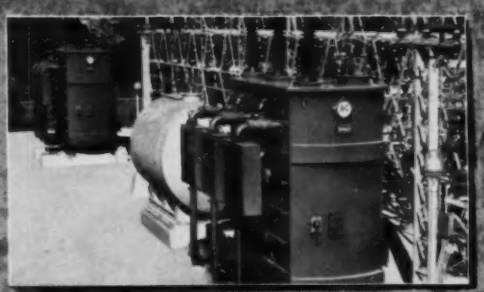


MIDWEST — Wisconsin Electric Power Company's Harbor Station, Milwaukee, Wisconsin, counts on designed-in emergency capacity. With A-C dual-cooling, either one of two 90-mva transformers can be uprated to 120 mva without loss of life. Dual-cooling also reduced initial transformer and foundation costs.

From coast to coast utilities get extra transformer emergency capacity at no added cost



EAST — Philadelphia Electric Company's Eddystone Station has twin A-C 200-mva DUAL-COOLED transformers that jointly carry the output of one generator. With inter-connected manifold-cooling, one transformer can carry practically the entire load of the generator if the second transformer is out of service.



SOUTH — Gulf Power Company's Bayou Chico Substation, Pensacola, Florida. Previously applied on only larger transformers, A-C dual-cooling offers economies for smaller units too. Here, either of two 20,000-kva DUAL-COOLED transformers can be uprated to 26,667 kva.

DUAL-COOLED transformers boost emergency capacity without loss of life! Throughout the nation more and more utilities are turning to DUAL-COOLED transformers as an economical new way to get central station and substation emergency capacity. DUAL-COOLED transformers—an Allis-Chalmers development—utilize a bank of two or more transformers. During an emergency, while one transformer is off the line, its cooling equipment is connected to the functioning transformers. Result: Capacity of any DUAL-COOLED transformer can be increased over its normal rating. *Dual-Cooled transformers is an Allis-Chalmers trademark.* A-1468

FOR DETAILS CALL YOUR NEARBY A-C OFFICE OR WRITE

ALLIS-CHALMERS

POWER EQUIPMENT DIVISION, MILWAUKEE 1, WISCONSIN

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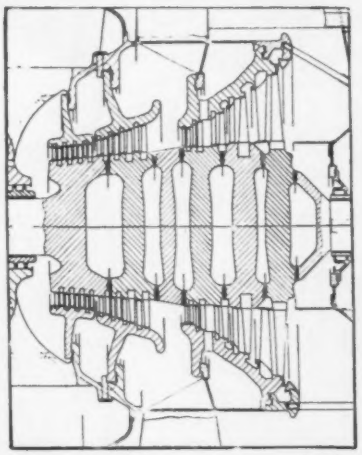
Welded sectional rotors for steam turbines

BROWN BOVERI

By N. K. Halsteen, Project Engineer, Brown Boveri Corp.

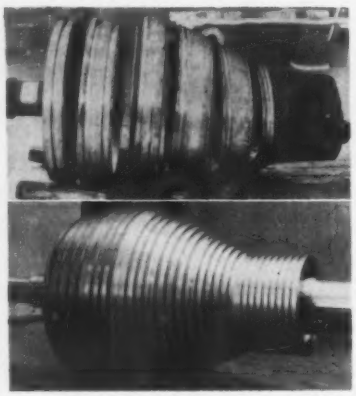
The manufacture of large, solid, one-piece rotors presents problems in detection and inspection of flaws, often resulting in the difficult choice of scrapping an expensive forging or completing the rotor with a "patch" or with an internal flaw whose effect in operation cannot be predicted with certainty. In use, the mass of a solid rotor also causes difficulty in maintaining tight shrink fits for the wheels and prevents uniform heat distribution for short start-up or shut-down schedules.

To avoid these difficulties, Brown Boveri developed a rotor made of forged discs and hollow, bell-shaped end sections welded together at the rims, forming a light, strong, rigid unit.



Cross-section of low-pressure stage showing welded segments of rotor shaft.

How Brown Boveri sectional rotors are made



Above: Sections of shaft ready for welding.

Below: The shaft after welding, heat-treatment and machining.

The rotor is assembled vertically on a turntable, the sections being centered by spigots. As the workpiece rotates past welding heads, the butting surfaces are welded. Welds are made at several points around the section at the same time—to prevent distortion. The welding is done automatically by the tungsten inert-gas process . . . providing homogeneous welds free of slag.

After a few layers of weld, the root is checked with gamma rays. If approved, the welding is completed.

After a final ultrasonic test, the welded area is given stress-relief heat treatment, with the rotor in vertical position. Machined rotors are tested at 40% overspeed before blading . . . also balanced statically and dynamically after blading.

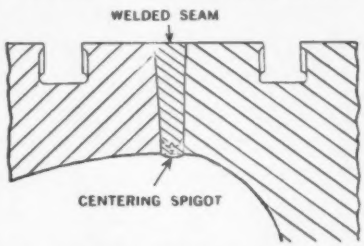
Advantages of sectional rotors

Because of the relatively small size of each section, forging conditions meet ideal metallurgical requirements. Inspection can be complete. Doubtful sections are scrapped without any attempt at "patching." Possible asymmetries resulting from forging are cancelled by the chance disposition of individual sections.

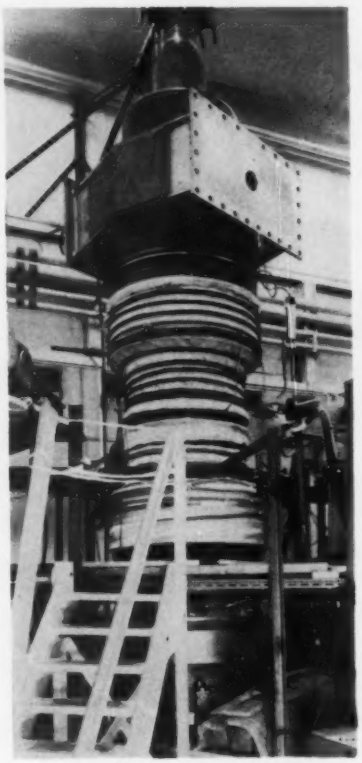
The stress-relieving procedure practically eliminates asymmetrical stresses.

The low mass of the rotor results in a favorable mass ratio between rotor and casing . . . with far less critical expansion differentials during sudden load changes or short start-up and shut-down schedules.

As evidence of its sound engineering, the Brown Boveri sectional rotor design has been used for over 30 years in several thousand rotors—and without a single explosion or other serious rotor failure.



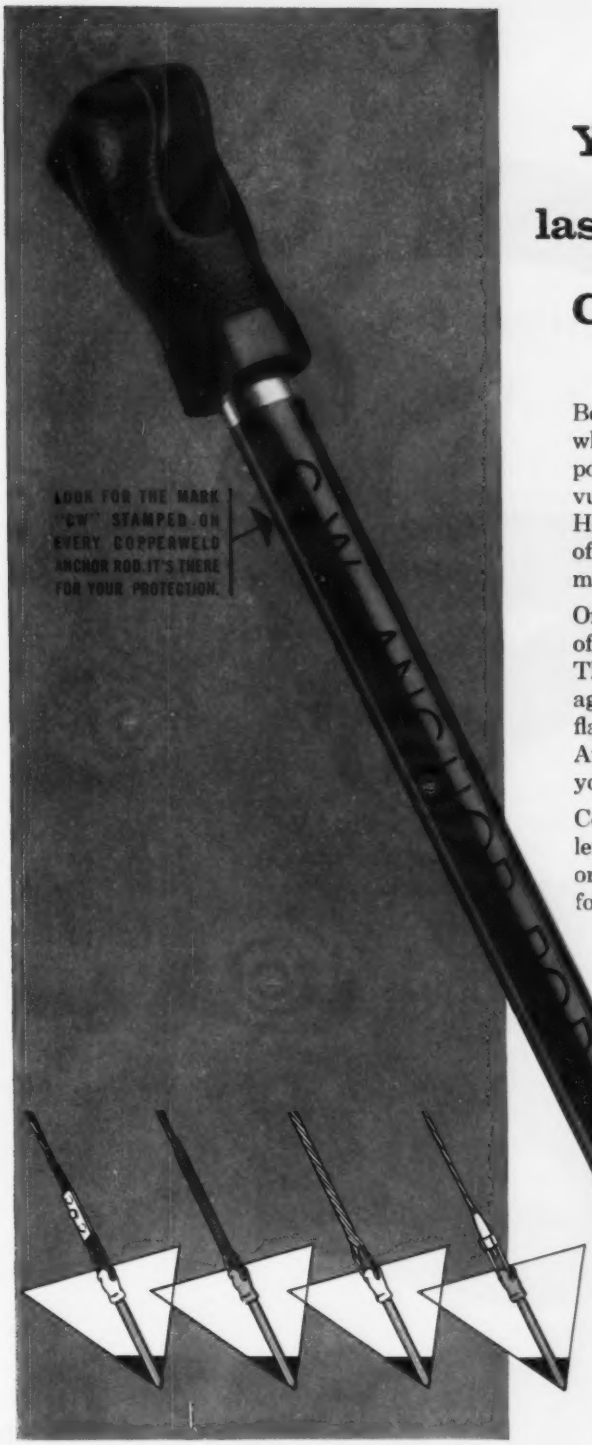
Cross-section of weld seam. Note uniform thickness of rims at weld — for minimum thermal stresses.



Automatic welding of sections. Also shown are insulating blanket and induction heating cable for pre-heating before welding and stress-relief treatment after welding.

Other features of Brown Boveri steam turbines: an all-hydraulic governing system without rods, levers or mechanical joints subject to wear and resulting inaccuracies . . . and an unequalled reliability of service illustrated by many Brown Boveri turbines built 40 to 45 years ago and still in continuous operation.

BROWN BOVERI Brown Boveri Corp., Dept. EL7, 19 Rector Street, New York 6, N.Y. Agents in 27 U.S. cities



FERROUS OR NON-FERROUS FITTINGS CAN BE USED WITH COPPERWELD ANCHOR RODS.

The threaded ends of each Copperweld Anchor Rod are heavily coated with pure tin to permit the use of ferrous or non-ferrous fittings.

You get lasting security with Copperweld Anchor Rods

Because an anchor rod is used in the ground where its entire length cannot be seen, its holding power is often taken for granted. Yet, anchor rods are vulnerable—primarily at or just below the ground line. Here, the rods are subject to rusting and loss of strength due to the action of corrosive soils, moisture and air carried down by surface waters.

Only Copperweld Anchor Rods have a thick covering of copper molten-welded to a strong steel core. This method of manufacture assures lasting protection against corrosion. Since the copper cannot crack, flake or peel, the strong holding power of Copperweld Anchor Rods is always the same . . . protecting your overhead lines year in and year out.

Copperweld Anchor Rods are available in various lengths and diameters. For complete information on these non-rusting anchor rods, write for Engineering Bulletin E. D. 1883.

COPPERWELD STEEL COMPANY

WIRE AND CABLE DIVISION *Glassport, Pa.*

For Export: COPPERWELD STEEL INTERNATIONAL COMPANY, New York

Copperweld®

anchor rods

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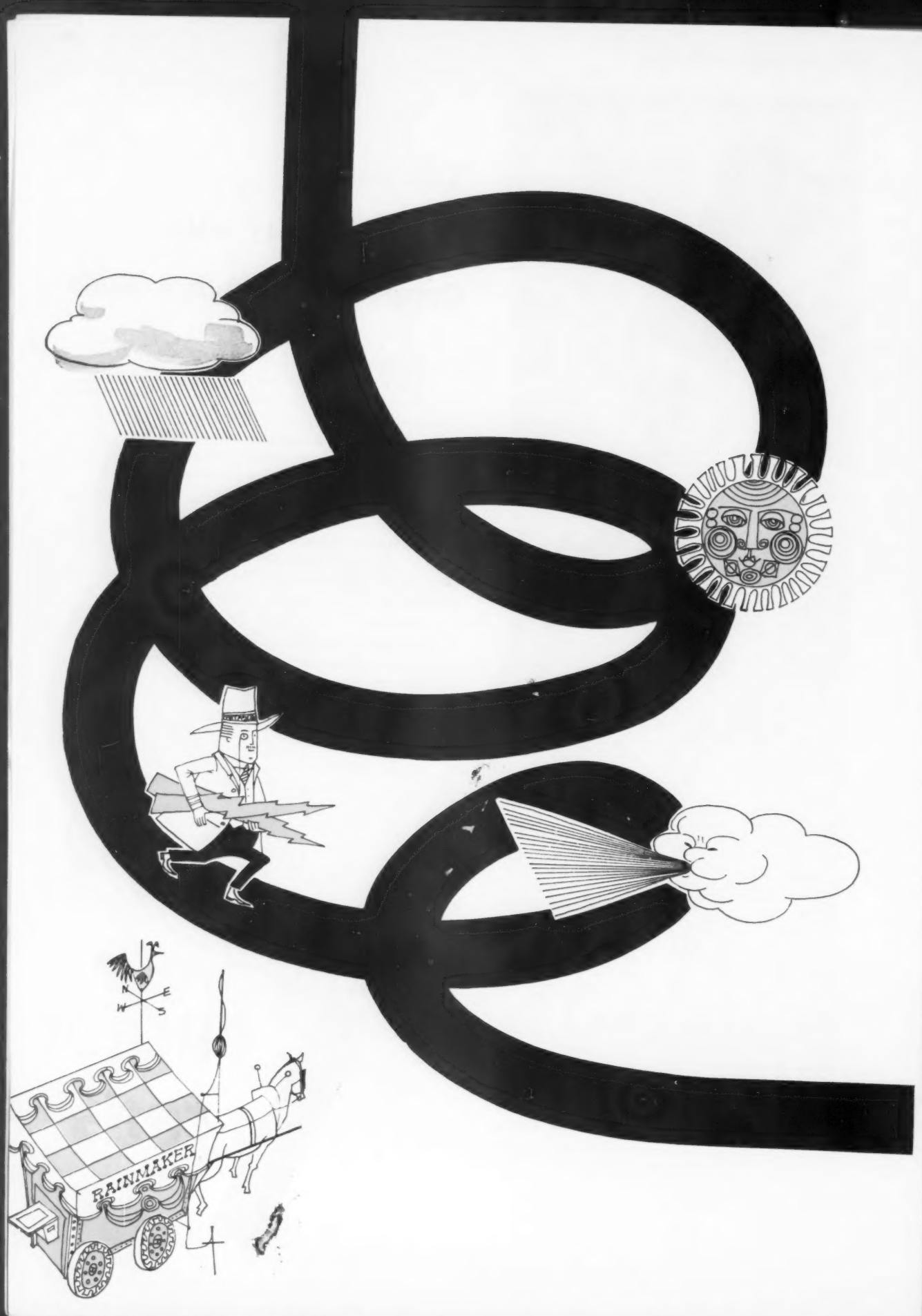
N
E
W
S
RAINMAKER

The difference in electrical cable starts with a rainmaker

You can't predict the weather but you can be sure USS Tiger Brand Cable has built-in weather resistance. In our research laboratory we create the worst possible weather conditions—baking sun alternated with driving rain—just to see how much torture a cable can stand. A few hours in our weather-ometer is the same as years of actual service. After this accelerated aging, we thoroughly test all the insulating and jacketing materials used in Tiger Brand Cable. We check for cable stability, tensile strength, elongation and flexibility. A microscopic examination checks for crazing and cracking. Various chemicals, micro-crystalline waxes and other antiozonants are then added to the insulating compounds to reduce ozone cutting and increase weather resistance.

This is just one of the many ways our Research and Development Department makes sure the quality of USS Tiger Brand Wire and Cable is the best you can get. Our research laboratory tests all materials used in Tiger Brand products. We experiment with new materials and methods to make Tiger Brand Wire and Cable even better. We have the facilities, right in our laboratory, to make all kinds of experimental cables—from control cable up to high voltage cable.

That's why, whatever the job, it pays to specify USS Tiger Brand Electrical Wire and Cable. You can't buy better cable. American Steel and Wire, 614 Superior Avenue, N.W., Cleveland 13, Ohio.

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Home of Mr. and Mrs. B. G. Bergeron, Montebello, California

WHEN THE FUTURE IS ALL-ELECTRIC

WHY BUY ANYTHING BUT A ***TOTAL-ELECTRIC GOLD MEDALLION HOME?***

"When we built our Gold Medallion Home, I discovered how simple and inexpensive housekeeping can be," says Mrs. Bergeron. "Everything stays so clean. I do my own work, yet I have *more* time to enjoy my family. An all-electric home is the only really modern home."

Count the things that change for the better:

1. Flameless electric heat. "Electric heat is *even* heat—no too-hot rooms or cold ones. And no discoloration on walls and ceilings."

2. A flameless electric range. "I love to cook with electricity—you know just how long each type of food will take. And it doesn't soil my pans—I save hours of scrubbing every week."

3. A flameless electric oven. "My electric oven keeps the tasty juices *in* the meats—cooks them so tender."

4. A flameless electric dryer. "Electric drying keeps towels and sweaters fluffy as new. I even put in my 'drip drys' and they come out wrinkle-free."

5. A flameless electric water heater. "Our electric water heater operates quickly, quietly and economically." Being flameless, electric water heaters can be placed anywhere—in a closet, in a corner or under a cabinet.

WHAT IS THE GOLD MEDALLION HOME AWARD?

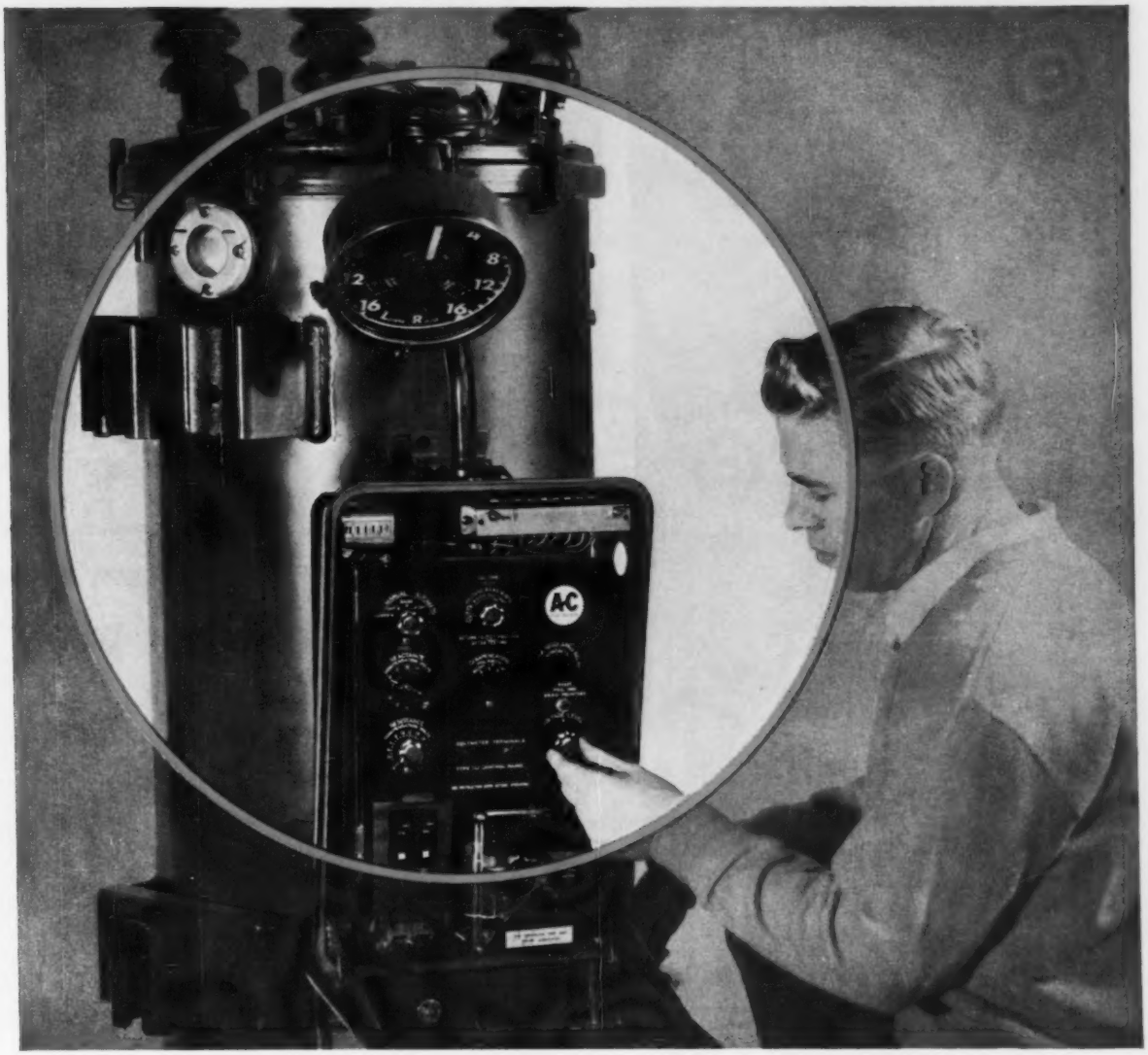
It is an award given only to total-electric homes that are electrically up-to-date. When a new home meets Gold Medallion Home requirements you know it offers: *clean, flameless, electric space and water heating; a clean, flameless, electric kitchen*, equipped with major appliances; plenty of "*Housepower*"—modern wiring to handle today's and tomorrow's appliances; *abundant lighting*, planned for comfort, convenience and beauty.

It costs so little to live better electrically. Why not move up to a total-electric Gold Medallion Home?

SOUTHERN CALIFORNIA Edison COMPANY

ALLIS-CHALMERS

Originators of 5/8% Step Regulators



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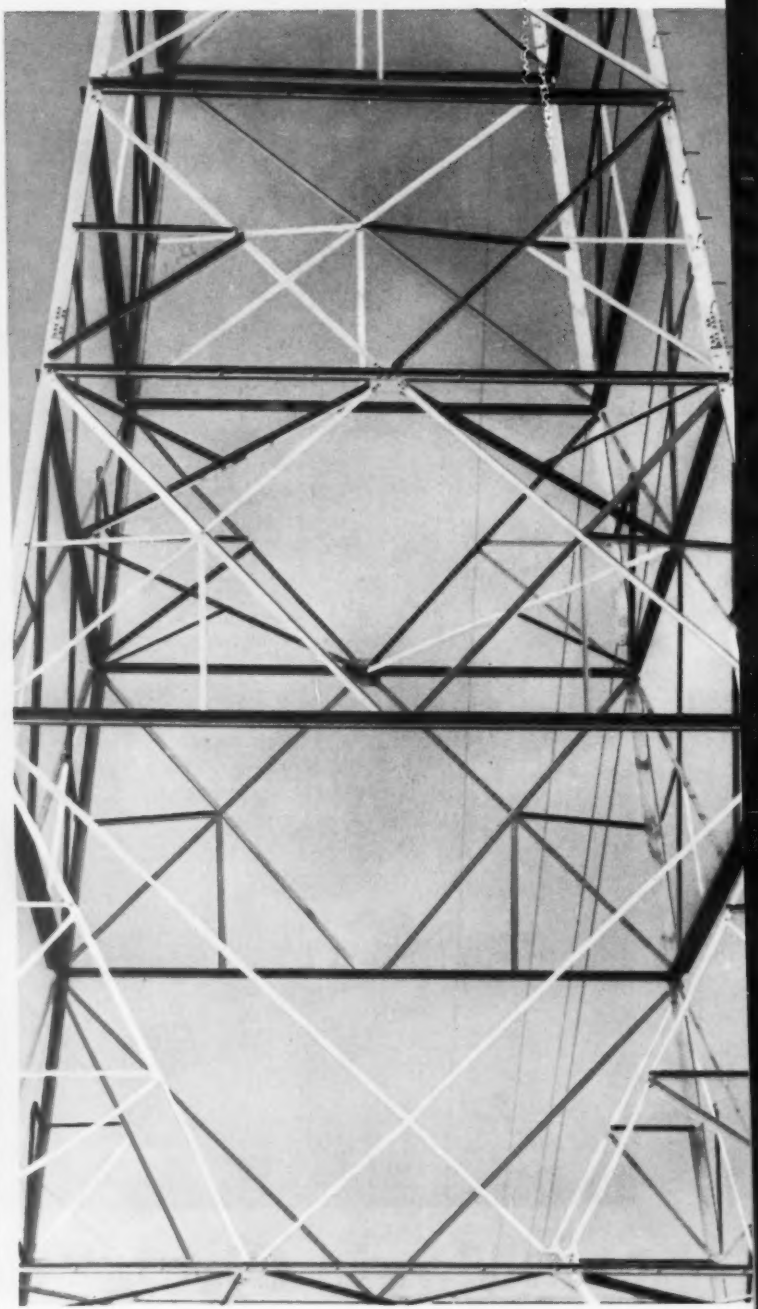

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NEWS

Edited for the electrical industry of the West

Merger Becomes Effective

Merger of California Oregon Power Co. into Pacific Power & Light Co. became effective June 21. Announcement was made by Paul B. McKee, PP&L's board chairman, and A. S. Cummins, Copco president, following authorization by regulatory commissions.

Cummins and Glenn L. Jackson, Copco vice president, will be board members of the enlarged utility.

Present personnel will operate the California-Oregon properties as the Copco Division of Pacific Power. Addition of Copco's 93,000 customers will give PP&L a total of 411,000. Combined revenues in 1960 were $88 million and utility plant investments total $577 million.

Generating capability of power plants in the consolidated properties is approximately 1,300,000 kw, of which 406,000 kw are on Copco lines. Construction expenditures within the next five years probably will total more than $250 million, it was stated.

Under the merger agreement, holders of Copco common stock will receive 1.2 shares of PP&L common for each share of Copco. Preferred stockholders of Copco will exchange for PP&L preferred on a share-for-share basis.

Erie Voters Approve Sale

Residents of Erie, Colo., approved the sale of its 60-year-old municipal electric distribution system to Public Service Co. of Colorado. The plan to sell the system and grant Public Service a 25-year franchise was passed by the voters 7 to 1.

PSC said the Erie system will be entirely re-engineered and rebuilt by the company. Both electric and natural gas will be served. The town has had no natural gas service in the past.

Public Service officials said the town of 875 people will receive a minimum of $60,000 in taxes in one form or another over the life of the franchise.

Western Underground Standards

The Western Underground Committee has prepared proposed standards for 15-kv pad-mounted transformers. The drawings are being distributed to committee members for their study and it is expected that action will be taken at the next meeting. The committee has members from most utilities in California, Arizona and Nevada. The next meeting is scheduled for September in Burbank, Calif.

Utility Valuations

Valuations of California utilities for property tax purposes have been set tentatively by the State Board of Equalization. For the first time Pacific Gas and Electric Co.'s valuation was topped by another utility, Pacific Telephone & Telegraph, which was assessed at $1,149,000,000. PG and E was assessed at $1,125,000,000, up $62,975,350 from last year.

Other valuations: California Oregon Power Co., $12,250,000, up $1,007,230; San Diego Gas & Electric Co., $124 million, up $12,685,140; Southern California Edison Co., $582,250,000, up $34,217,620; California Electric Power Co., $63.5 million, up $5,499,590.

It is estimated that California's 58 counties can expect to share $20 million in additional taxes in the 1961-62 fiscal year. Utilities paid about $271 million in taxes this year.

► Gov. Mark Hatfield has vetoed a bill passed by the 1961 legislature, **which would have permitted the state highway department to pay cost of utility relocations** in connection with highway projects. The governor said the bill violated Oregon constitutional provision limiting use of state gasoline tax funds to road and highway purposes.

► **Lower rates have been put into effect for mercury vapor street lights** in Pacific Gas and Electric Co. territory. The reduction, which reduces company revenue by an estimated $71,000 annually, was approved by the California PUC on request of PG and E.

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Power Export Advised

Export of power is the only way in which British Columbia can secure low-cost power under the existing industrial economy of the province, Dr. Gordon Shrum, chairman of the B. C. Energy Board, told the B. C. Chamber of Commerce at its annual convention at Vancouver.

He said that regardless of what energy source was used low-cost power could only be produced in big plants and he pointed out that B. C. in itself could not absorb a big output. He said the province was only using 10% of its 33,000,000-hp hydro potential and cannot expect to use it within the next 40 years.

Dr. Shrum is dean of graduate studies, University of B. C., and he stressed the fact he was not giving a preview of the energy board's report, due for presentation to the B. C. government later this year, but was speaking as a physicist.

Highlights of the speech:

The costs of hydro, atomic and thermal energy now average out to roughly the same.

B. C. has already lost a market in the Pacific Northwest for export power until 1970 at least and the only market is California.

The downstream benefits provided for in the Columbia treaty have "befuddled" some Canadians into thinking that they are getting something for nothing.

Figures on Columbia power provided by Ottawa indicate that Columbia power may not be cheap but would compare with the cost of power produced by the B. C. Electric's Burrard thermal plant.

British Columbia will certainly get either Peace or Columbia power, probably both.

300,000-Kw Units Considered

The Bureau of Reclamation is considering the possibility of using 300,000-kw generating units, which would be the world's largest, for the proposed third power house at Grand Coulee Dam.

If requested funds are approved by Congress, the bureau plans to start a study in July on the feasibility of the third power house, which would be made possible by storage projects in Canada that could be built under terms of the U. S.-Canadian River Treaty.

Officials of the bureau's Columbia

Basin project offices indicated that the number and size of the generating units to be installed in the proposed power house would depend on completion of studies that would update a 1954 report. Main generators at Grand Coulee now have a capacity of 108,000 kw each and the rated capacity of the project is now about 2,000,000 kw.

Coal for Generating Plants

Coal is becoming a logical fuel source for electric generating plants, according to Dr. John W. Reith, associate professor of geography at the University of Southern California.

He pointed out that increasing costs of oil and natural gas, along with the expanding demand for power, are actually prompting the use of coal, the price of which has remained relatively stable.

Although anti-smog restrictions would preclude the burning of coal in the Los Angeles area, Reith believes that it would be economically feasible to serve Los Angeles from a plant in Utah. In fact, placement of a generating station at the minehead would eliminate freight charges, which are currently more than half the cost of delivering Utah coal to Los Angeles, he said.

Movie Saves Life

Two 13-year-old Astoria, Ore., boys—Bill Sutton and Jimmie Venable—were honored by the Exchange Club of Astoria for saving a child's life with the mouth-to-mouth resuscitation technique they learned from a safety movie exhibited by Pacific Power & Light Co. The film was "Rescue Breathing" which PP&L had provided for showing at their school. Prints of this film and another movie about mouth-to-mouth breathing, "That They May Live," are in constant circulation through the company's service area and have been shown to school children, PTA groups, civic organizations, first aid classes and other groups.

And So Does Radio

Portland General Electric Co. figured it was adding a little to the lives of night owls when it sponsored a midnight to 6 a.m. classical music radio show, but it didn't expect to save one. However, a listener, who had dozed off, credits PGE's program with saving his life. Awakened by an unusually loud passage of music, he found his wastebasket blazing ominously, he reported.

This picture, taken six minutes after water flow was started, shows rate of washout for the fuse plug model at Idaho Power Co.'s Oxbow Dam project on the Snake river

Savings from Fuse Plug Spillway

Idaho Power Co. is saving an estimated $800,000 on construction of Oxbow Dam by use of an unusual "fuse plug" spillway.

The Oxbow project, under construction in the Hells Canyon stretch of the Snake River between Oregon and Idaho, is expected to be completed this year. It will have a conventional concrete spillway on the Oregon side and a fuse plug spillway on the Idaho side.

The conventional spillway will have a capacity of about 150,000 cfs, enough for any expected flow on the river. If more capacity is needed, the fuse plug will provide another 150,000 cfs.

The fuse plug design resulted from a joint effort by research men at Washington State University at Pullman and engineers of Idaho Power. Research work was handled by the R. L. Albrook Hydraulic Laboratory of the WSU Division of Industrial Research.

Dr. E. Roy Tinney, head of the laboratory, explained that a fuse plug is simply a rockfill dam with a special arrangement of the impervious core and strict control of the rockfill and filter materials. It has a factor of safety equal to that for ordinary rockfill or earth dams when it functions as a dam. However, it will be washed out by the reservoir water automatically at a suitable rate when the extra spillway capacity is needed. The washout has no effect on the main dam structure.

► **Black Hills Power & Light Co.** has asked the Wyoming PSC for approval to issue $1,000,000 in first mortgage bonds. The sale will net the company $961,200, which will be used to finance its 1961 construction program and repay short-term bank loans.

Fred Klumb of Southern California Edison Co., left, will complete his six months' stay at G-E's project EHV in July. Third utility man to study and work at the project near Pittsfield, Mass., Klumb, a member of his company's transmission design group, has majored in "corona loss and radio influence studies." Shown here with him is Harrison Wright of Pennsylvania Power & Light Co., who was just completing work at the project

WASHINGTON REPORT

Protective Legislation Proposed

The first detailed proposal of how legislation might be drafted to "protect" Northwest markets from demands in other areas—in the event of a transmission intertie from Bonneville Power Administration to California or elsewhere — has been made public in Washington by Bonneville leaders.

The plan is considered only a first draft, and is expected to be changed considerably by the time comments come in from interested state and federal agencies and Bonneville customers. Final administration draft isn't expected to go to Capitol Hill for introduction until sometime late this fall.

Interior Secretary Stewart Udall, who has seen the first draft but insists it's only a "Bonneville plan," intends to introduce protecting legislation separately and ahead of any authorizing legislation to build a big inter-region tie line. That probably won't come until sometime next year.

In simple terms, the proposed Bonneville bill would set up a double preference standard—the first in the Bonneville area along precisely its present criteria; preference customers first; private utilities and industrial customers afterward—the second would apply to non-Bonneville regions where preference, then nonpreference customers, would be supplied after the Bonneville area loads had been met.

All Bonneville's sales (contemplated in this proposed bill) outside its territory would be of secondary power and peaking capacity, in excess of its foreseeable requirements. Power contracts outside the Bonneville territory would include the following restrictions:

1. Sale of energy would require a seven-day pullback clause.

2. Contracts for peaking capacity would require a 42-month termination clause, plus the purchaser being required to return, during his own off-peak periods, energy to supply this peaking capacity.

3. Hydro power that Bonneville could conserve in storage, not immediately needed for Northwest markets, could be sold outside the Northwest on the requirement that the full amount of energy must be returned — or any portions thereof— during the purchaser's off-peak periods.

Nonfederal utilities in Bonneville's territory would be included in estimates of Northwest needs "only to the extent that it (the utility) has taken all reasonable measures to assure the availability of its own supply for its own future needs."

The Secretary of Interior, under the terms in the proposed draft, could order power exchanges between Bonneville and other areas (probably other federal systems — Central Valley, Missouri Basin, Lower Colorado) over an intertie "to the extent required to coordinate the operation of such generation facilities," if he finds this to be "in the interest of the United States and of each of the areas involved. . . All benefits, including increases in firm power resulting from coordinated operation, shall be shared equitably by the plants or systems involved."

Terms of the proposed legislation would not apply to power benefits to be derived from the also-proposed U. S.-Canadian treaty for development of the Columbia River.

Another Battle on Burns Creek

The controversial federal Burns Creek reclamation project, on the Snake River, appeared slated for another dragged-out battle in the House interior subcommittee on reclamation. Hearings have been completed on the 90,000-kw, $50 million project, but opponents on the subcommittee—led by Rep. John Saylor (R-Pa.)—are using the full bag of parliamentary procedures to block committee approval. Last year, after many months of closed session debate, the subcommittee recommended Burns Creek's approval, by voice vote, to the full committee—where it died as the session closed.

USBR Has Bridge Canyon Plan

The Bureau of Reclamation appears heading toward re-entry into the Bridge Canyon hassle between the city of Los Angeles and the Arizona Power Authority. The bureau reportedly has sat back enviously, while Los Angeles and Arizona pushed their conflicting license applications for the project before the Federal Power Commission.

Presently, the FPC has granted both applicants approximately a six-month delay to consolidate their rival applications into a single, joint application—minus the added Marble Canyon development that Arizona had tied in with its Bridge Canyon application. Arizona had proposed a 960,000-kw, $193 million Bridge Canyon project. Now the bureau is talking in terms of a 1,500,000-kw development at the site—possibly to be built federally.

Goes to Committee

The Fryingpan-Arkansas reclamation and water diversion project, Colo., has moved forward quickly in the House interior subcommittee on reclamation. Slightly more than two weeks after hearings were first held on the project this year, the subcommittee recommended its approval, by an unrecorded voice vote, to the full interior committee. Full committee approval apparently is assured.

The $170 million project, to divert west slope water into the Arkansas River Valley on the east slope of the Continental Divide, should face a stiff fight on the floor of the House of Representatives; but chances are that it will be approved by that body this Congress. The Senate will await the House's action, before it takes up the project.

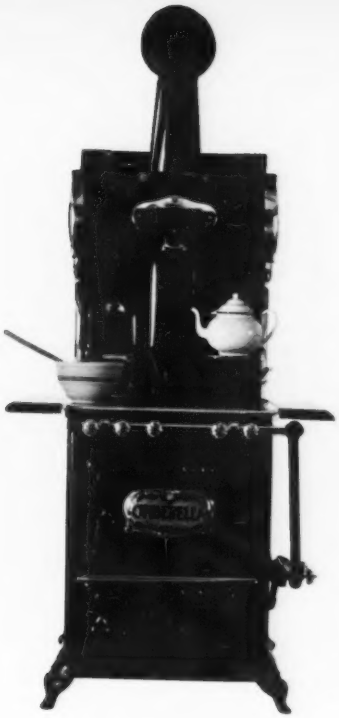
Fryingpan this year would provide for 123,900 kw of generating capacity on the Arkansas River.

Headed for a Showdown

The complicated and very heated battle between Nez Perce and High Mountain Sheep license applicants was headed for a showdown in June in rebuttal arguments before FPC Examiner William Levy.

Regular hearings have been completed in the complicated case. And only final rebuttal arguments remained, as ELECTRICAL WEST went to press, before Levy was slated to take the case into advisement and issue his intermediate recommendation.

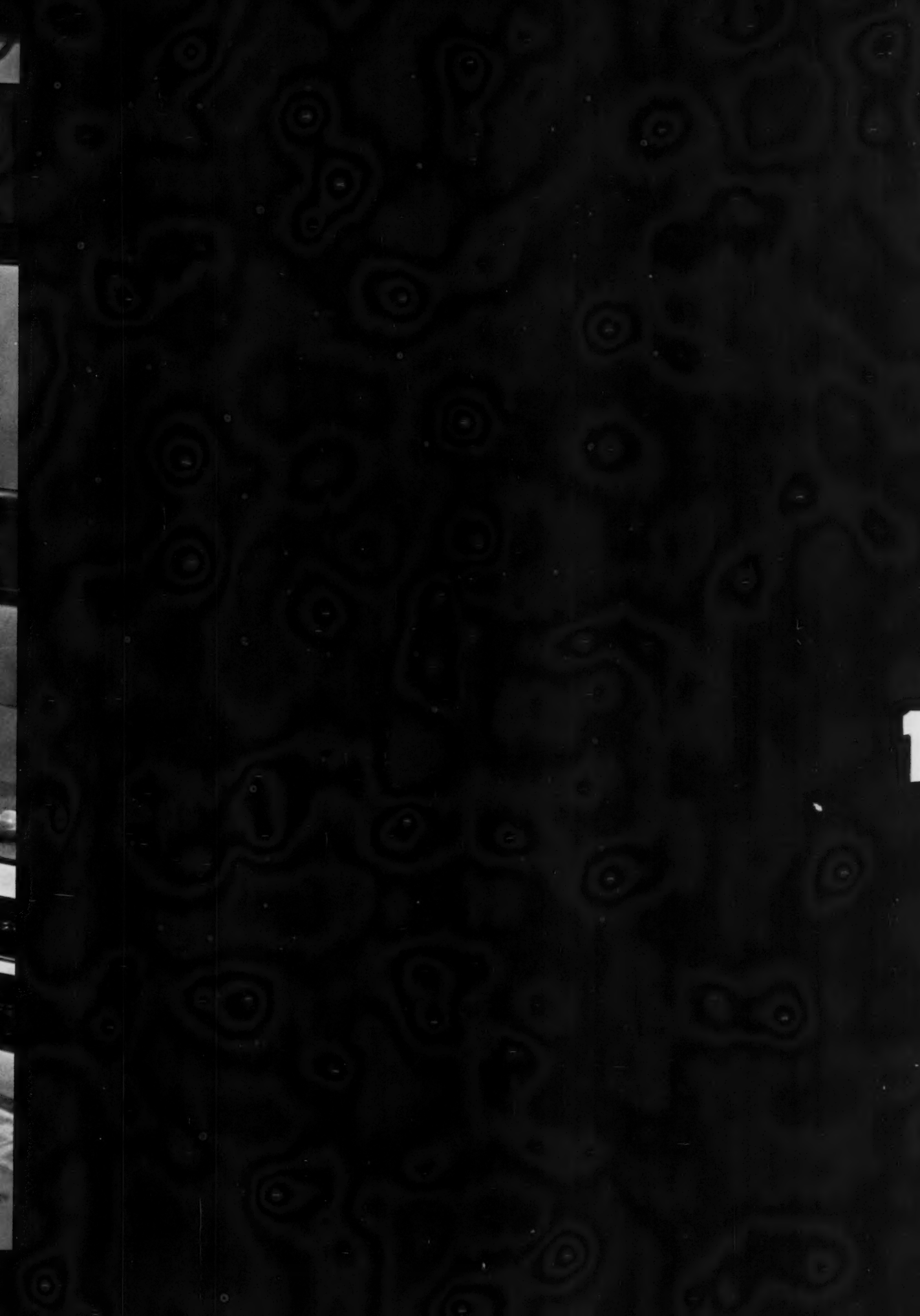
A major unanswered question is what the coming Democratic majority on the FPC will do to Interior Secretary Udall's request that the case be delayed four years, until Interior can complete a crash program on high dam migratory fish facilities. Present FPC Chairman Jerome Kuykendall hasn't answered Udall's request. The FPC majority is expected to shift from Republican to Democratic after June 22, when President Kennedy will be able to nominate a new commissioner to replace Arthur Kline. That would give the Democrats a 3-2 edge. Joseph Swidler and Howard Morgan are Democrats, Kuykendall and Fred Stueck are Republicans. The new commission would tip the scales.



Is your distribution system planning

Obsolete?

125



LL65

The distribution transformer that served the home with a ga stove and ice box is obsolete when it comes to serving today electric home. Modern residential loads demand a transforme that can be overloaded (handle the peaks), minimize regulatio problems (keep the customer's service voltage up), and operat economically at all loads (lower losses). The new Westinghous LL-65 distribution transformer meets these requirements. It is modern as the total electric home it is designed to serve. Wit the new INSULDUR insulation system, it can operate at 65° rise and still carry 180% nameplate rating. It has a lower impedanc to maintain good customer voltage; a new ratio of losses to reduc operating costs at all loads. The new LL-65 CSP has built-i lightning and thermal protection, bird and squirrel protectio new Hi-Temp WEMCO-CH insulating oil, and signal light t indicate break-even point for changeout.

Modern distribution system planning calls for a transformer design that can serve your present loads, yet be able to handle ever-increasing future load requirements—and do it economically. The Westinghouse LL-65 is that transformer. It reduces the number of changeouts required as load increases, reduces maintenance, and gives greater service life. For the transformer that will give you more performance per distribution dollar, yet is still flexible enough to meet your growing distribution demands, ask your Westinghouse representative about the LL-65. It's the transformer built today for tomorrow's loads. **You can be sure... if it's Westinghouse.**

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GROWTH

Rocky Reach Power

Representatives from the Puget Sound Power & Light Co., Washington Water Power Co., Pacific Power & Light Co., Portland General Electric and Aluminum Co. of America, all potential power purchasers of the Rocky Reach hydroelectric commercial power, Wenatchee, Wash., recently met at Chelan Public Utility District to inspect the development.

The PUD board chairman, Ivan Compton, and assistant manager, Hower Elmore, advised the group that the project on the Columbia River will cost approximately $10 million less than estimated, and first commercial power will go on the line in about 30 days.

Coulee Expansion Plans

Generators of 300,000-kw capacity are being considered in planning for a third power house at Grand Coulee Dam, says Secretary of Interior Stewart Udall.

They would be the largest in the world, almost three times as large as the 108,000-kw generators now operating at the dam. Russia has some of equal size, but the largest U. S. generators are 150,000 kw.

The Bureau of Reclamation will begin a study of the proposed third power house after July 1 if Congress authorizes funds requested by his department, Udall said. Additional water to be provided by Canadian storage projects under a pending treaty is expected to make a 600,000-kw additional installation feasible.

The study would require about 2½ years and work on the generators might begin as early as 1965, Udall said.

Wells Dam Design

The Douglas County PUD has accepted the recommendation of its consulting engineers that proposed Wells Dam on the Columbia River at Azwell incorporate the power house, switchyard, spillways and fish ladders in a single structure.

The dam will be the first of its kind in the United States, although the unit design has been tried in several foreign countries, the PUD said. Work is scheduled to start in mid-1963 on the 568,000-kw project.

Decision to depart from traditional dam design followed extensive economic and engineering studies by the Bechtel Corp. of San Francisco. The design separates the generators in "cells" and uses the space between for spillway openings. Staircase-type fish ladders at either end of the structure also will serve as walls for earthen embankments on either side. The switchyard will be located on the structure's deck.

Yuba River Project

Voter approval has been given to a gigantic new California water project on the Yuba River involving the construction of five dams, three power houses, 10.4 miles of main canals and 40.8 miles of tunnel excavation.

Yuba County, Calif., voters by an 11-to-1 margin authorized the issuance of $185 million in revenue bonds to finance construction.

A report prepared earlier this year by International Engineering Co. Inc. of San Francisco estimated construction costs at $151,270,000 but the Yuba County Water Agency, which will build the project, asked for the $185 million bond authorization to take care of contingencies.

In declaring the project feasible. IEC said the sale of project power to the Pacific Gas and Electric Co. offers the most attractive revenue-raising possibility to retire the revenue bonds over a 45-year period.

SMUD Bonds

Directors of the Sacramento Municipal Utility District have awarded a $1,429,602 contract to the Donald M. Drake Co. of Portland, for construction of Union Valley power house, a unit of the district's Upper American River project. The contract will include construction of the power plant building, installation of a portion of a penstock and building an access road. A 33,000-kw generator contract already has been awarded by SMUD.

SMUD directors, June 1, will sell $30 million in revenue bonds, the third and last sale of an $85 million bond issue authorized by district voters in December 1955, for construction of the Upper American River project.

Cost of the project will exceed the $85 million. The Bechtel Corp. of San Francisco, consultant hired by SMUD to prepare an economic study of the project, has reported the district not only will be able to furnish funds for the project's costs in excess of the $85 million bond authorization but net revenues will be sufficient to service all bonded debt and provide funds for additions and betterments on the electric system of the entire SMUD service area.

New Heco Plant

The State Harbor Board recently gave Hawaiian Electric Co. the "go ahead" for a new power plant at Kahe Point.

The site has been master planned for a nuclear power plant, but company officials said such an operation is still years away—that the earliest possibility for a nuclear operation would be 1967, but no date has been set. Officials say they will build a nuclear plant here when it is "economically feasible." Their study continues.

Rocky Mountain Power

Rocky Mountain Power Co. of Denver, Colo., has filed an application with the Federal Power Commission seeking a license for a proposed hydroelectric project on the South Fork of White River and Sweetwater Creek, both tributaries of the Colorado River, in Garfield and Eagle Counties, Colo.

The proposed project would consist of two earth- or rock-fill dams with related storage reservoirs, three diversion dams, two power houses having a combined capacity of 150,000 kw and appurtenant facilities. The cost of the project is estimated at about $50 million.

Rocky Mountain proposes to sell power generated at the project to the Public Service Co. of Colorado.

REA Loans Approved

Alaska: Homer Electric Assn., Homer, $21,000 to aid consumers finance wiring and installation of electrical appliances.

Colorado: San Luis Valley Electric Cooperative, Monte Vista, $427,000 to finance construction of distribution line and general system improvements.

Montana: Glacier Electric Cooperative, Cut Bank, $1,518,000 to finance 59 miles of 69-kv line, 22 miles of 34.5-kv line, and 74 miles of distribution line.

Valley Electric Cooperative, Glasgow, $128,000 to finance construction of 18 miles of distribution line.

New Mexico: Jemez Mountains Electric Cooperative, Espanola, $1,219,000 to finance construction of 302 miles of distribution line and 68 miles of 69-kv line.

Springer Electric Cooperative, Springer, $25,000 to aid consumers finance wiring and installation of electrical appliances.

Arizona 345-Kv Line

Arizona Public Service Co.'s 345,000-v transmission line connecting Arizona load centers with the company's Four Corners power plant in northwestern New Mexico will be constructed jointly by the Howard P. Foley Co. of Salt Lake City and Washington, D. C., and Jelco Inc. of Salt Lake City, it was announced recently.

A. H. Forman, Public Service executive vice president, in making the announcement said the low bid price on the line project was $17,481,077. It was also announced that T. G. Woods Jr. of Phoenix would serve as project manager for Public Service.

Etiwanda Addition

California Public Utilities Commission has given authorization to Southern California Edison Co. to construct a third steam-electric generating unit at its Etiwanda steam station in Fontana, Calif. The first two units of this station were opened in July and November 1953.

The new unit will include a steam turbine-electric generator and new double circuit 220-kv transmission facilities between the station and Mesa and Highgrove substations. The turbine-generator will have a rating of 310,000 kw, resulting in a total station turbine-generator set rating of 560,000 kw.

Puget Transmission

Plans for construction of a $7,000,000 transmission line from the Columbia River, with work to start this summer, were announced recently by Puget Sound Power & Light Co.

The new 230-kv line, with a receiving substation at Auburn, will replace an existing 115-kv line that has been in service for 37 years. It will extend 131 miles from Rock Island Dam, built by Puget Power but now the property of the Chelan County PUD, and will be constructed with 1,274 mcm ACSR.

The wood-pole line will carry power not only from Rock Island Dam but also from Rocky Reach and Priest Rapids Dams, now being completed by the Chelan and Grant County PUDs, respectively. Puget Power has contracts to purchase power from both of the new dams.

COMMUNICATIONS

Radio Groups Elect

In anticipation of the annual meeting of NCUR, several of the Western region sponsor radio associations have had their meetings and elected new officers.

The Northwest Utility Radio Assn. met in Butte, Mont., and elected the following: Chairman, J. E. Scofield, Eugene Water & Electric Board, Eugene, Ore.; vice chairman, F. D. Emigh, Department of Public Utilities, Water Division, Tacoma, Wash.; secretary, A. A. Noon, Puget South Power & Light Co., Kirkland, Wash. The frequency coordinator's job was split among E. C. Phillips, Northwest Natural Gas Co., W. D. Leidigh, Portland General Electric Co., and L. A. Carter, Pacific Power & Light Co., all of Portland.

The **Southwest Committee for Utilities Radio** meeting in San Francisco resulted in the election of the following: Chairman, Earl Rapp, Mountain Fuel Supply, Salt Lake City; vice chairman, Fred M. Winckel, Los Angeles Department of Water & Power; R. M. Connelly, Sacramento Municipal Utility District; and frequency coordinator, L. D. Martin, Arizona Public Service Co., Phoenix.

The **Rocky Mountain Radio Assn.** held its meeting in Denver and chose the following officers: Chairman, Don Miller, Hot Springs County REA, Thermopolis, Wyo.; vice chairman, Bruce McKenzie, Mountain Parks Electric Co-op., Granby, Colo.; secretary, R. B. Moore, Lea County Electric Co-op., Lovington, N. M. Frequency coordinator for this group will be selected later by the executive council. L. E. Hayworth, immediate past chairman of RMURA, also reports that Joe Keller, counsel for NCUR, happened to be in Denver at the time of the meeting, and they were pleased to have him for a guest speaker.

► What may be the first electric utility use of **knife edge refraction** has been in operation for about eight months by Portland General Electric Co. Bill Leidigh of that company reports that both high and low band VHF radio circuits have withstood seasonal variations without serious effects. The path is approximately 85 miles long and extends from near Portland at an elevation of 1,025 ft to Pelton with an elevation of 1,023 ft. Between them is a ridge approximately 7,000 ft high at the point where the beam crosses. Directional antennas are used and their orientation proves that the signals are not the result of reflections.

► Sometime ago we mentioned **ducting of radio signals** due to atmospheric conditions. Since that time there has been considerable interest and experimentation in this field. The original tests traversed a distance of only 1,500 miles. Recently an Air Force research group beamed 425-mc radar signals from Trinidad to the Atlas Mountains in Africa, a distance of 3,900 miles, and received strong return signals. The particular duct used was at an elevation of 5,000 ft, making it difficult to enter. If these ducts prove stable or predictable we may get an intercontinental duct radio system ahead of the satellites.

► **Electronic techniques** have improved the accuracy of **ground resistance measurements** at B. C. Electric, according to Hugh Goldie of that company. Realizing that measurements at 60 cycles would yield the most usable results, they have devised a means of eliminating the problem of ground currents at most substations. Briefly, an oscillator and high-power amplifier are used to supply current at frequencies above and below 60 cycles, and meters with tuned filters are used for the measurements. Interpolation of the results at 60 cycles yields highly accurate results for the ground resistance or, more correctly, the ground impedance.

► **An electronic telephone switchboard** has been placed in experimental operation in Morris, Ill., by the Illinois Bell Telephone Co. The equipment is wholly solid state and electron tube in nature and uses no mechanical components for any of its functions. Transistors supply the logic circuits, storage tubes the temporary memory, and photographic plates the permanent memory. Line connections are made by means of gas tubes instead of the familiar stepping switches of crossbar relays. Logic and memory portions of the board are physically separate thus making it possible to study the programming of hitherto impossible functions, such as automatically having your phone calls transferred to other numbers belonging to friends

where you were visiting. Not the least of its advantages would be the tremendous increase in operating speed – but to use it to advantage will require something other than the present dial, perhaps push buttons.

► **The end of developmental microwave licenses** for Power Radio Service users finally appears to be in sight. The commission has recently proposed to regularize authorizations for microwave above 952 mc, which is covered by the interim technical standards of docket 13083. These standards are to become effective after July 20, 1961, and they propose to regularize all authorizations issued after this date, or for which applications have been received prior to this date. This will eliminate the annoying annual license renewal and operational report. However, type approval equipment must be used as is now required in the regular service. Since many of the systems now in use could not comply with all of the requirements, a grandfather clause will permit their continued use for some time at least.

► **Better not start construction** of radio facilities before you actually obtain the CP from the FCC. It's a temptation sometimes to get started about the time the CP should be due; however, if you will read the rules you will find that such action, if discovered, will result in the rejection of the application and the necessity of a lot of explanations. In a recent case an industrial user erected a new tower to replace one that had been damaged, but did not obtain permission from the FCC to do so. Eventually the commission discovered what had happened and, after the smoke had cleared, issued a new CP, but it specifically enjoined them from using the existing tower. That hurt.

► A new telephone company, **Pacific Northwest Telephone Co.,** is being formed from Pacific Tel & Tel holdings in Washington, Oregon and some of Idaho. Reason given is that PT & T has grown to such an extent that it is desirable to split it up for easier management. If approval is received from the various regulatory bodies, the new company will emerge early this summer.

► **Mobile Radio Telephone for Automotive Use,** a booklet published by the Society of Automotive Engineers, 485 Lexington Ave., New York 17, N. Y., is available to members for $1.50 and to non-members for $3.

MARKET DEVELOPMENT

PROSPECTIVE BUYERS in Santa Maria were given estimated operating cost figures for all-electric living and told advantages of clean, safe electric heating.

Cooperation Makes Sales, Reasonable Operating Costs Make Friends

T.W. FULLER, RESIDENTIAL UTILIZATION ENGINEER, PACIFIC GAS AND ELECTRIC CO.

All-electric living **can** be sold to prospective home owners.

This can best be accomplished when a builder, a utility company and an equipment manufacturer cooperate in telling the total electric home story.

Home buyers become satisfied customers when proper installation results in reasonable operating costs.

These points were well proved when Westinghouse and PG and E cooperated with the Atlantic and Pacific Building Corp. in promoting one of the West's first tracts of total electric homes located on natural gas lines, in Santa Maria, Calif.

The question asked most frequently by prospective buyers was "How much will it cost to operate this home?" This question was understandable. To most home buyers the concept of total electric living was new, and reports on electric operating costs, especially electric heating, were conflicting, to say the least.

A simple, authoritative way to sell all-electric living was needed by the real estate salespeople. PG and E's residential sales department worked out an estimated average operating cost for normal family use under normal Santa Maria weather conditions. Itemized lists showing these estimates were printed on pocket-size cards to help the real estate salesmen in answering inquiries. Appliances and lighting estimates were shown on both a monthly and an annual cost basis, and so was electric heating.

Westinghouse and PG and E briefed the real estate sales organization on the many benefits of all-electric living available to purchasers of these homes. A PG and E home economist demonstrated the electric features of the model kitchens, and pointed out how to use the electric equipment, including heating, economically.

The homes sold rapidly when customers were shown all the modern electric work savers for convenient living and were told of the cleanliness and moderate operating cost of electric heating.

The homes have full housepower for present and future appliance needs, baseboard electric heating, and Westinghouse kitchens including a 24-in. oven and automatic platform range, roll-out dishwasher, food waste disposer, and family-size water heater. All homes include a living room, dining room, kitchen, three bedrooms and two baths. Ceiling areas are covered with 4 in. of mineral wool insulation, and there are 2-in. insulating batts in the outside walls.

For use of the above appliances and heating, plus TV, hi-fi, refrigerator, automatic clothes washers, a variety of portable appliances, and other general purpose uses of electricity, the estimated cost per average home was set at $21.45 per month. This figure was based on an average home size of 1,268 sq ft in area.

Now that the owners have been enjoying all-electric living for a complete year in these Santa Maria homes, PG and E has compiled electric operating cost data using averages developed from 36 case histories. Figured on a 12-month basis, the average cost per month for the homes was $22.27, just 82¢ over the original estimate of $21.45, this de-

spite the fact that California had one of its most severe winters in the past several years.

Because 10.6% of annual degree days were experienced during the three low-cost operating months, electric heating costs cannot be definitely segregated from the total cost. The highest average monthly electric bill was $30.70, and the lowest was $14.89. Understandably, the highest averages came in January and February, with the lowest in August.

"We feel these figures indicate clearly that cost of operating total electric Gold Medallion homes on our lines is completely within the budget of most families," says John S. C. Ross, manager of residential sales for Pacific Gas and Electric Co. "We firmly believe that these actual operating costs will help in selling more and more builders on the total electric way of living."

Aid to Home Buyers

Southern California Edison Co. is cooperating with Bryan Publications and builders in providing a comprehensive listing of what is available in housing, how much it costs and where to find it. The handbooks, which are revised every three months, are available free of charge at Edison commercial offices, key highway service stations and restaurants, real estate brokerage offices, Chambers of Commerce, title insurance companies, school districts, military bases and major industries. First area selected was Ventura County. Ten area publications to follow will cover the Edison system.

Garden Lighting Contest

Washington Water Power Co. and the Inland Empire district of the Washington State Federation of Garden Clubs are sponsoring a garden lighting contest this summer.

The federation includes 85 clubs with a total membership of more than 2,000. Each of the participating clubs will have a garden lighting contest and the winner will represent the club in the finals. Cash prizes will be awarded for first, second and third place winners in the finals and club winners will receive merchandise awards.

Garden lighting projects of the individual club winners will be judged during the last week of August and the winners will be announced at the Sept. 8 meeting of the federation.

Blair Plowman, commercial sales supervisor for WWP, said the purpose of the contest is to demonstrate the beauty, low cost and simplicity of garden lighting.

In addition, WWP and the Inland Empire Electrical League started an advertising campaign to emphasize the advantages of outdoor lighting. The ads are built around the theme of "Beautify Your Yard and Garden." The ads stress that outdoor lighting in garden and play areas adds hours of pleasure all summer long.

Customer Information

New literature has been prepared by Tacoma Department of Public Utilities to tell the public about its facilities.

One booklet, entitled "Glad You Came In Today," is for visitors to the utilities center. It lists the average cost per month of operating various appliances; important dates in the history of City Light; comparisons of Tacoma's power costs with those in other cities; information on changing a fuse and resetting a circuit breaker; tips on methods of using power most effectively.

Another folder, "Scenic Storehouses of Power," describes recreational facilities at City Light dams.

Both booklets were prepared by Bill Dugovich, public relations supervisor for the department.

Sales Booklets

A personalized touch is given **Arizona Public Service** Co.'s 1961 Marketing Program booklet, by lettering the recipient's name on page one and letting it show through a cutout in the cover. Thus the minute the salesman picks up the booklet, he sees his own name with the admonition "Get there *first* and Sell." The promotion calendar in the back is thumb indexed by month.

B. C. Electric has put out a simple, easy to use program guide, giving saturation at the end of 1960, unit sales last year and forecast for 1961.

Smaller in format, about 8½x6 in., and running to more pages than most, the **Southern California Edison** booklet is divided into sections by colored index cards. Sections are well arranged under subheadings to make wanted information easy to find. A handy 1961 diary takes up the last section.

"You're the 1 in '61, Sell Total Electric" is **Utah Power & Light's** slogan for the year. Copy and illustrations keep the eyes on the target, the consumer dollar.

Plan 1962 Show

Representatives of five trade associations have met to coordinate and launch plans for the 12th national Air Conditioning, Heating & Refrigeration Industry Convention and Exposition scheduled to be held in Los Angeles Feb. 12-15, 1962.

The event will mark the first time the show has been held west of Chicago, and the meeting is expected to bring the largest attendance in ARI history.

An estimated 500 manufacturers will exhibit products at the show and a turnout of 15,000 persons is expected.

H. T. Jarvis, president of Recold Corp., Los Angeles, is general chairman of the ARI exposition.

The coordinating groups are Western Air Conditioning Industries Assn., Refrigeration Service Engineers Assn., Air Conditioning & Refrigeration Wholesalers Assn., Refrigeration & Air Conditioning Contractors Assn. and American Society of Heating & Refrigeration Engineers.

► At a breakfast meeting in the Reef Hotel on June 1, **PCEA touched off its current room air conditioning program.** First of a series to be sponsored for distributors and dealers, the meeting was attended by 12 representatives. Guest speaker was Herbert B. Stellmacher of University of Hawaii's economics faculty. The campaign, to run from June 4 to Aug. 31, includes free installation and an intensive advertising program. As an incentive for retail salesmen, ten week-end holidays for two at Kauai Surf Hotel will be awarded.

► Ground has been broken in Downey, Calif., for that **city's largest Gold Medallion apartment** development. D. R. Dickson, Southern California Edison manager in the area, reports that 66 dwelling units are being constructed for the HP&D Co. by Barsh & Lowy. The structure was designed by Arnold A. Aveis, AIA, Los Angeles.

► "As the next best thing to a chat "with each of its 700,000 customers, Pacific Power & Light Co. has prepared **a booklet of helpful hints and information about electric service.** The handy folder includes a map of the company's service area; tells how to read an electric meter; gives information on billing; gives such hints as what to do when moving, and what to do if the power is interrupted.

Modern Street Lighting Sells Homes in Portland

Modern residential street lighting has become a real estate salesman in Portland, where a new mercury vapor luminaire is helping to sell houses in a first-rate suburban development. Last fall, Alcan-Pacific Co., developer of Furlong Park southwest of the city, decided to modernize the area's incandescent street lighting and turned to Portland General Electric Co. for advice. PGE's answer: mercury vapor lighting.

The company has found that people, when given the choice, invariably select mercury vapor lighting for residential areas. This is contrary to what its sales department thought would be the case when it was busy some years ago promoting mercury vapor for commercial areas. "Frankly, we're pleased about this," says Leo E. Chaffin, assistant general sales manager, "because the higher efficiency and lower maintenance costs of the mercury more than offset the capital cost differences and enable us to give the customer more light for his dollar."

The M-250R, latest in General Electric's type M-Line, was chosen to do the job. "This unit has stamped the Furlong Park area as a really modern residential development," commented Arthur Moffat, PGE's Tualatin Valley Division sales manager. "Residents of the area are pleased that the units do a good job of keeping light away from bedroom windows and down along the street where it belongs."

Before the new luminaires were mounted, Furlong Park residents formed a lighting district, named five commissioners, and signed a rental contract with PGE.

The enthusiasm of the developer is apparent from the fact that about half of the luminaires are in areas where homes have not yet been constructed. The modern, pleasing appearance of the units by day and uniform brightness by night lent new appeal for prospects and the developer is paying rental for them to the utility.

Portland General Electric Co. retains ownership of the luminaires, brackets, poles and distribution equipment; provides all maintenance, replacement and electric power for the fee. It charges $3.25 a month per luminaire, with a $2.15 charge for each metal pole, bringing the total monthly fee per unit to $5.40.

The Furlong Park area is a typical residential layout, consisting of curves and T intersections, so pole spacing was a problem. Average spacing is 210 ft, with the units mounted 25 ft above the 28-ft roadway. Each luminaire carries a 175-w, 7,000-lumen clear mercury vapor lamp. The average maintained footcandle level is 0.4, well above the American Standards Assn. minimum recommendation for residential streets.

Each unit is photoelectrically controlled, providing automatic dusk-to-dawn operation.

The trend in PGE's area, according to Moffat, is toward more residential street lighting, both in incorporated and unincorporated areas. "We plan to promote mercury for residential applications, except where we are intermingling with existing incandescent installations," he said.

To help promote its progressive street lighting program, the utility maintains an outdoor laboratory showing typical mercury, fluorescent and incandescent lighting.

"One good way to sell a lighting job is to show your customer how it will look and how it will perform," Moffat says.

Mercury vapor units were used to modernize the street lighting in this first-rate suburban development near Portland

► **Philco** has moved its San Francisco office from the Russ Building to the Van Ness-Post Center Building, 1255 Post St.

W. Floyd Lovelace, residential sales manager of the Los Angeles Department of Water & Power, presents a Gold Medallion award to Al Sachs and Jerry Crane (flanking him) of Crestland Building & Investment Co., builder of the 120-unit Diplomat in North Hollywood. Department sales representative Howard Goodman looks on at right. Largest total electric apartment building constructed on department lines to date, the Diplomat was built at a cost of $2,000,000, is electrically air conditioned and heated, and offers such luxury features as a therapeutic hot swirl pool, conventional swimming pool, individual poolside telephones and FM music, a putting green and game room

NUCLEAR NEWS

Nuclear Power Plant to Be Air-Lifted

The first nuclear power plant for the Air Force, prefabricated into 16 packages, took to the air last month for a 1,700-mile trip to a Wyoming mountain top. The plant, incorporating a pressurized water reactor, was built for the Air Force by the AEC under a joint program of the commission and Corps of Engineers. The Martin Co., Baltimore, was the prime contractor for the plant.

Air Force C-130 Hercules transport aircraft is carrying the packages. One flight will be required for each package and completion of this job will be made in July.

The reactor is scheduled to achieve criticality in September. It will be cooled and moderated by light water and will be fueled with highly enriched uranium. When the plant is operational it will provide 1,000 kw of electricity and 2,000 kw of heat for the Air Defense Command at Sundance, Wyo.

This plant was designed to provide for factory-assembled packages, both for air transportability and for quick assembly, so that nuclear power can be made available any place in the world where Air Force units may be needed.

Electric Generator Features Proposed for Hanford Reactor

The atomic energy authorization bill for fiscal 1962 contemplates the expenditure of $95 million for the addition of electric generating facilities to the new production reactor at Hanford, Wash.

This plutonium production reactor was authorized last year, at which time $25 million was included to allow for the future addition for these generating facilities.

There are opposing views as to the desirability of authorizing $95 million to make the production of some 700,000-800,000 kw possible.

The view of the Edison Electric Institute was stated in a letter from Sherman R. Knapp, president of the institute, to Congressman Holifields. He said:

"Construction of power-producing reactors should be consistent with the research achievements of developmental programs. Improvement in technology, not the addition of kw, should be the immediate objective of our nation's nuclear power program. Power requirements should be met with the most economical means available in the various regions of our country. We believe that experience to date confirms the wisdom of this approach.

"The expenditures of money for generating facilities to utilize the low-temperature, low-pressure steam available from NPR will not advance our nation's nuclear power development program. So far as power production is concerned, the Hanford reactor represents retrogression rather than progress. Any experience in fuel design and operation that might be learned from the reactor can be obtained without the addition of facilities to utilize low-temperature, low-pressure steam. The Hanford steam plant cannot possibly be justified on the basis of making a contribution to nuclear power technology.

"The reactor obviously produces heat that can be utilized. But the advancement of nuclear technology and the utilization of the most economical means of producing power in the Northwest should be uppermost in our minds and not the utilization of steam which can be considered primitive in our modern utility technology. The uneconomical use of the low-temperature, low-pressure steam of the NPR will not add to our prestige in the internatoinal scientific community, nor will it advance nuclear technology.

"Rather than spend taxpayers' money for facilities that will not make a contribution to nuclear power technology, it would be more profitable from the standpoint of the nation's progress in nuclear power development if money were spent on more basic projects such as nuclear fuel research.

"Furthermore, we believe that the building and operating of any thermal plant for the production of power for sale to the public by the federal government is contrary to the public interest and American principles. It is not a proper function of the federal government and is not necessary. During these times when there is a great need for large and necessary governmental expenditures for national defense and international requirements, it is important that the federal budget not be burdened with expenditures for electric power development which can be financed in the free market. The Hanford steam plant would establish a dangerous and unnecessary precedent in this regard and in addition is not economically sound and will not make any contribution to civilian nuclear power technology."

The opposite view was expressed by Dr. Glenn T. Seaborg, chairman of the AEC before a special hearing of the joint committee on atomic energy. During this hearing Dr. Seaborg, on behalf of the commission and its staff, recommended the authorization of construction of electric generating facilities at the new Hanford production reactor.

Revised Charges for Uranium

The AEC has announced that on July 1, 1961, the base charges for enriched and depleted uranium will be reduced and the use charge for this material will be increased.

The reduction in base charges will vary from 20% for highly enriched uranium to 34% for uranium containing 1% U-235. The reduction in charges approaches 40% as the U-235 content nears that of natural uranium and ranges up to 63% for depleted uranium.

This reduction in base charges is made possible by decreased costs of natural uranium. The new charges correspond to a price of $8 per pound for uranium oxide in natural uranium concentrates established for the period April 1, 1962, to Dec. 31, 1966.

The present commitments by the AEC as to prices for plutonium and uranium-233 at $12 per gram and $15 per gram, respectively, through June 30, 1963, will not be affected by this announcement.

The annual use charge rate will be increased from 4% to 4.75%. This is the charge paid by reactor operators for leasing fissionable fuel from the commission. This change takes into account the increase in cost of money to the U. S. government since the rate was first established. However, since most licensed power reactors in the U. S. have this use charge waived during the first five years of operation, this increase will have no immediate effect.

The net effect of these changes will be to reduce the cost of nuclear power. This reduction, however, will vary from one reactor to another and will result in a relatively small decrease in total cost. This is true because the cost of uranium and the lease charge are only a part of the total fuel cost and the total fuel cost is less than half the total cost of power from a nuclear plant.

ASSOCIATION AFFAIRS

Officers Elected

Among many associations elections of new officers have taken place recently but not have been reported here.

The Electrical Inspectors' Assn. of B. C. elected its 1961-62 officers at its recent annual meeting, naming John D. Holdom, city of Vancouver electrical inspector, as president; George A. Harrower, Electrical Energy Inspection Division of the Provincial Government, vice president; J. R. Walker, senior electrical designer, Provincial Government, treasurer; and John R. Dooley, secretary-manager, Electrical Service League of B. C., as secretary. This organization met jointly on June 3 in an international meeting with the Puget Sound Chapter, International Association of Electrical Inspectors, at Hotel Leopold, Bellingham, Wash.

Electrical Industry Depository of California Inc. recently elected officers and directors for 1961, naming Paul Marin as president; Robert Hupp vice president; Aldo P. Lera secretary-treasurer; and among the directors Richard Coopman, A. H. McAulay, Guido Menicucci, J. M. Mihalovich, Dean W. Skanderup and Noble Wright. J. R. McManus is custodian with headquarters at 1355 Market St., San Francisco.

Across the bay at the Electrical Industry Bid Depository of the Bay Counties Inc. Administrator Tom J. Ryan announced the election of Harold Pierce to the board of directors, representing Napa-Solano Counties; Borise L. Larson, representing Contra Costa County; and Al Weber Jr., representing Alameda County. President is W. J. Nagel. J. W. Barnes is vice president; Harold Pierce secretary-treasurer; Jack Vance, Borise L. Larson, L. H. Misner, Al Weber Jr., Robert Covey and George Crane are directors.

At the National Association of Electrical Distributors annual convention in Detroit, May 3, Kendall Paul Rehwaldt, district manager, General Electric Supply Co., Los Angeles, was re-elected vice president of the Western region. Among the new members of the board of governors elected for Zone 10 were Ira M. Beck, Central Electric Supply Co., Denver, and C. D. Lawrence, State Electric Supply Co. Inc., Albuquerque, N.M. NAED was currently holding area meetings throughout the West. The southern California meeting was held June 2 and 3 at Apple Valley Inn and the northern California area meeting at Ahwahnee Hotel, Yosemite Park, June 9 and 10.

Electric club elections are usually held at this time of the year. The **San Francisco Electric Club** recently elected Tom Neikirk, Line Material Industries, as its president to succeed Karl Bausch of Bechtel Co., and named Leon Guibara, Kaiser Wire & Cable; Hugh James, ELECTRICAL WEST; George Abbett, electrical contractor; and William Poynter, Federal Pacific Electric, as directors. Secretary again will be Charles Huyck, retired.

Across the bay at the **East Bay Electric Club** in Oakland Acting President Robert B. Scholes, General Electric Co., was made president for the new year with Douglas Aiken, PG and E, vice president; Charles R. Matthews, State Electric Supply, secretary-treasurer. Directors elected were A. T. Wiemken, James Gallagher, Elmer N. Lago, William H. Gribble, George Baker and E. M. Buttner.

Vancouver Electric Club in British Columbia named as its president James E. Milburn, Northern Electric Co. Ltd., C. G. Mostyn, Canada Wire & Cable Co., vice president; H. G. Foster, Northern Electric Co., secretary; J. H. Radcliffe, Canadian Standards Assn., treasurer; A. M. Thompson, Canadian General Electric Co., finance minister; G. V. Webb, B.C. Electric Co., chaplain; J. H. Taylor, B.C. Electric, mister constitution; L. B. Stacey, Ferranti-Packard Electric, historian; James Todd, B.C. Electric, musical director; and E. Wolstencroft, English Electric Canada, his assistant; and E. W. Johnson, Canada Wire & Cable, sergeant-at-arms.

Team to run the Santa Clara-San Benito Chapter, NECA, after George Harter goes to San Francisco: Dick Wilkinson, chapter president; George Flint, division manager at Santa Barbara; and Neal Mangin, who steps up from that to chapter manager

Sacramento Valley Electric League, Electrical Construction Section, recently elected John Pineau, Nutone Inc. representative, as chairman. Results of the other executive committeemen elected have not been announced.

► **Los Angeles Chapter, National Electrical Contractors Assn.,** recently established a new San Fernando Valley Division. It already has divisions in San Bernardino and branches at the Harbor area and Pasadena.

► **Southern Colorado Chapter, NECA,** and Local 113, IBEW, held the 16th annual apprenticeship completion ceremony at the Antlers Hotel, Colorado Springs. Completing apprentices numbered 13. James E.

Kidded as well as honored by 524 members of the entire electrical industry when he retired was William R. Volheye, chief electrical inspector for Oregon. Here he was put into a skit depicting his babyhood beginnings with electrical gadgets in his play pen. Volheye completed more than 50 years in the industry, since 1935 as state inspector. Among speakers were Merwin Brandon, president of Underwriters' Lab.

Laxson was chairman of the joint apprenticeship committee and of the meeting. Dr. Louis E. Benezet, president, Colorado College, was principal speaker. Certificates were presented by Allen Bader, president, Southern Colorado Chapter; Charles M. Carlson, U.S. Department of Labor; Keith Wiley, committee secretary; and Colorado certificates by Carl C. Ferris, State Board for Vocational Education; John L. Cameron, School District No. 11. John J. Donlon, manager, Local 113, and Willis Flora, president, presented journeyman cards. Simon Halle, manager, Southern Colorado Chapter, NECA, was on the arrangements committee.

► **Celebrating the 53rd anniversary of Local Union No. 617,** International Brotherhood of Electrical Workers in San Mateo, 16 members were presented pins honoring more than 25 years' membership. Albert E. Midgley of Palo Alto topped them all with the 50-year membership and was honored by Charles J. Foehn, District 9 IBEW vice president, and President Robert D. Walters and Secretary W. H. Diederichsen of the local union. Among the others receiving longevity pins were Noah Lambert of South San Francisco, 45 years; Stanton Mullen, Redwood City, 35 years; James J. Gorman, Redwood City, and Charles Schurk, Sebastopol, 30 years.

► Preliminary plans for the annual meeting of the **Southwestern Section, International Association of Electrical Inspectors,** were recently tentatively announced by L. E. LaFehr, secretary-treasurer. The familiar code workshop pattern will be followed with the exception that final reports of these workshops will not be acted upon until the final day of the meeting, leaving one day for the chairmen and secretaries to digest and prepare the results of the discussions in form for final action. Tentatively scheduled is an address by L. D. Price, manager of Engineering and Safety Regulations Department, NEMA, on "What Underwriters' Laboratories Means to the Electrical Industry." Other talks on technical problems, such as sprinklered areas containing ventilated bus ducts, switchboards and electrical equipment; electrical facilities in elevator installations, may likewise be on the program. The conference will begin with an executive committee meeting on Sunday, Sept. 17, and continue through Sept. 21 at Hotel del Coronado, Coronado, Calif. Arthur P. Vesco, San Diego chief electrical inspector, is section president.

PEOPLE

Howell

Doerr

Joyce

PG and E Announces Executive Promotions at San Francisco

O. R. Doerr, vice president in charge of sales for Pacific Gas and Electric Co. since 1948, was elevated to vice president and assistant to the company's general manager, S. L. Sibley, in executive appointments announced by President N. R. Sutherland.

R. W. Joyce was elected to the new position of vice president in charge of commercial operations and W. D. Howell was made general sales manager.

Doerr, a graduate of the U. S. Naval Academy, joined the sales department of Great Western before its consolidation with PG and E. He was appointed general sales manager of PG and E in 1938. He is serving this year as president of the San Francisco Chamber of Commerce.

Joyce has been manager of the commercial department since 1954. He was formerly with Puget Sound Power & Light Co. and was general commercial manager when he moved to San Francisco in 1947 to join PG and E.

Howell has been manager of commercial, industrial and agricultural sales since 1958 and previously was sales manager of the East Bay Division. He joined PG and E in 1926 while still a university student. He later received a master of science degree in business and engineering administration from MIT under an Alfred P. Sloan Foundation fellowship.

► Ending a 47-year career as an electrical engineer in private practice and government service, **Fred E. Anderson** has retired from the Sacramento District Army Corps of Engineers. For many years he was the chief of the mechanical-electrical section of the district, and for the past two years has been special assistant to the district's head designer, Harry A. Dettmer. Anderson began his career as a construction foreman for Pacific Gas and Electric Co. and served with the Army Signal Corps in World War I.

► **Blair A. Babcock** has been made employment manager for Pacific Power & Light Co. He joined PP&L in 1939 and has served in five company departments. His most recent assignment was assistant supervisor of the finance and statistical report section of the treasury department. Previously he had served as accountant, budget analyst, and wage and salary administrator.

Babcock

► **Wilbur L. "Bill" Warren,** formerly assistant chief engineer for California Oregon Power Co., has joined the engineering firm of Cornell, Howland, Hayes & Merryfield. Warren joined Copco in 1953 and served as resident engineer on several hydroelectric projects. For the past two years he has been assistant chief engineer. His first assignment with the Oregon engineering firm will be as resident engineer on the $2,000,000 Kingsley Air Force Base reconstruction project at Klamath Falls.

► **Charles Bell,** for some years lighting engineer for Southern Colorado Power Co., has joined the engineering staff of Colorado Fuel & Iron Co. in Pueblo, Colo.

► **Charles W. Kinney** was appointed assistant administrator for Bonneville Power Administration, effective July 15. He succeeds **J. Lane Morthland,** who resigned. Kinney has more than 25 years of government service. His background includes almost four years with TVA, nearly a year with the U. S. Public Health Service and over 21 years with the U. S. Corps of Engineers. In 1959 he served as adviser to the U. S. Section of the International Joint Commission in formulation of the principles for the cooperative development with Canada of the Columbia River resources. Later he was called upon to work with the U. S. delegation negotiating the Columbia River treaty with Canada.

► **Eugene Starr** will continue as chief engineer of the Bonneville Power Administration, Interior Secretary Stewart Udall announced early in June. Starr has been in the position since July 1954. Previously he served as consultant engineer for BPA with particular reference to transmission economics, high-voltage transformers and varied aspects of high-voltage transmission.

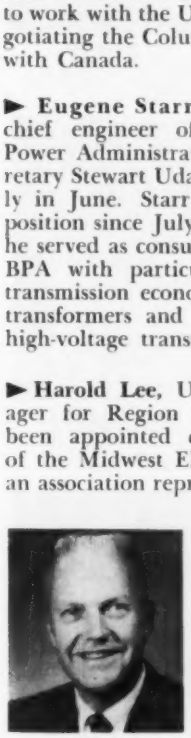
► **Harold Lee,** USBR power manager for Region 7 at Denver, has been appointed executive director of the Midwest Electric Consumers, an association representing 220 rural electric cooperatives in the Missouri Basin states. He succeeds Kenneth Holum, recently appointed to the Interior Department. Midwest Electric Consumers' offices will be moved from Aberdeen, S. D., to Denver, according to Lee.

► Named to the University of Nevada's electrical engineering Hall of Fame were **Fred L. Fletcher,** president of Sierra Pacific Power Co., Reno, and **Harvey F. McPhail,** executive director of the Colorado River Basin Consumers Power at Salt Lake City.

► **J. D. King,** area development representative, B. C. Electric, has been appointed industrial development manager of the company's marketing division. He succeeds **William A. Dow,** who has resigned.

► **Horace Fleming,** manager of the Kittitas County PUD at Ellensburg, Wash., has gone to East Wenatchee as distribution superintendent for Douglas County PUD. He was at Ellensburg for nine years.

► **John A. Fleming,** director of public relations for Northwestern Utilities at Calgary, Alberta, Canada, was elected president of the Public Utilities Advertising Assn. **Donald T. Spangenberg,** director of advertising for Public Service Co. of Colorado, was made secretary.



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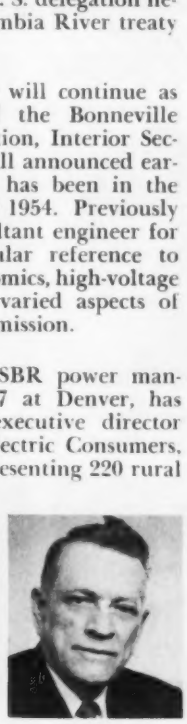
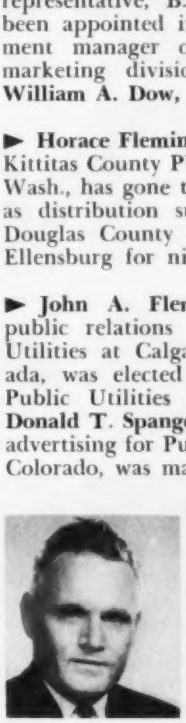
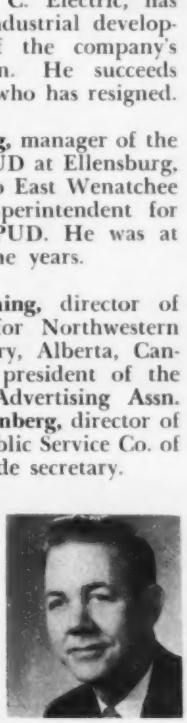


Anderson



Davis



King

Four Advanced at Seattle by Puget Sound Power & Light

Four executive officers have been elected by Puget Sound Power & Light Co. directors, according to an announcement by J. H. Clawson, president.

John F. Wallin, Northern Division manager at Bellingham, will become vice president of operations July 1. He will transfer to Seattle to succeed Edward A. Fontaine, who resigned to return to the Stone & Webster Service Corp. in New York.

J. E. Anderson, treasurer, was named vice president of finance and Ralph M. Davis, secretary, also was elected a vice president. John H. King will succeed Anderson as treasurer and also will continue his duties as controller.

Wallin started with the company in 1927 and has managed the Northern Division for 18 years. Anderson, who joined the company in 1921, succeeded Clawson as treasurer two years ago. Davis held several positions in state government before joining the company in 1957. He is a graduate of the University of Washington. King worked for Puget briefly in 1940 while attending the University of Washington but did not rejoin the company until 1956. He was named controller in 1959.

Cattolica

Peterson

► **William H. Peterson** has been promoted to the position of electric superintendent for Pacific Gas and Electric Co.'s East Bay Division, succeeding **William T. Hannum** who retired. Taking over Peterson's former post as superintendent of electric operations is **Joseph L. Cattolica.** Peterson started with PG and E as a power house operator in 1935, and has been in East Bay Division since 1955. Cattolica joined the company in 1937, and for the past year has been a senior engineer in the substation department of the San Francisco general office, headquartered at Fresno. Hannum closes a career of 41 years with PG and E. He joined the company in 1920 following overseas service during World War I.

► **Tom G. Woods** Jr. will act as manager for Arizona Public Service Co.'s Four Corners transmission construction project. He has been with the company since 1950, and has been distribution engineering supervisor since 1958. Believed to be the longest 345-kv line ever constructed under one contract in the United States, Four Corners will be constructed jointly by Howard P. Foley Co. of Salt Lake City and Washington, D. C., and Jelco Inc. of Salt Lake City.

► **Ted W. Litchfield,** formerly resident engineer for Oregon State Highway Department in Medford, has been named the department's utilities liaison engineer.

► **President N. R. Sutherland** of Pacific Gas and Electric Co. was inducted as honorary member No. 1 of the **Lamplighters of America,** national organization to promote safer nighttime travel. The group was formed as an offshoot of the IES to seek "better lighting of America's streets and highways for the common good and the safety of the traveling public."

► **Ivan L. Bateman,** Department of Water & Power, Los Angeles, was elected president of the American Public Power Assn. at the recent convention in San Antonio, Texas.

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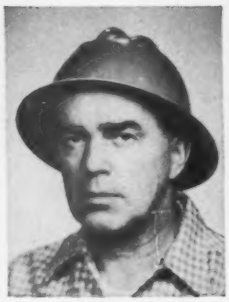

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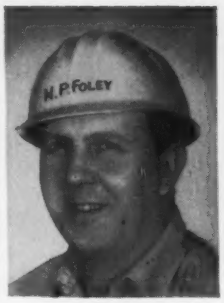

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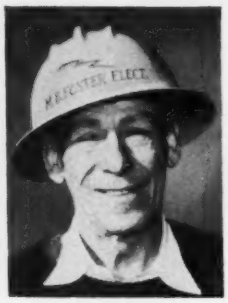

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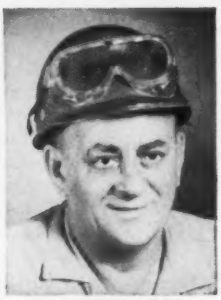

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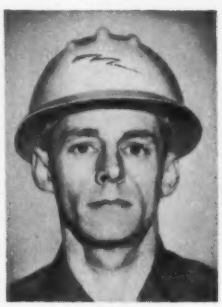

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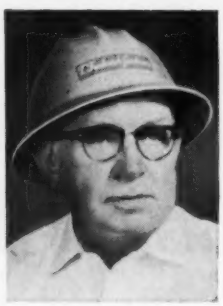

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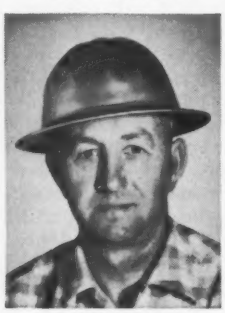

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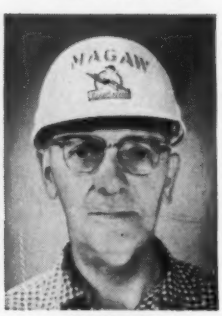

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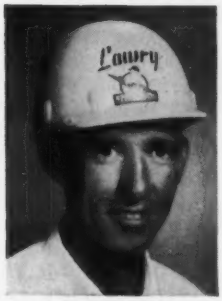

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► **Ralph Whelchel** has been named foreman of the Frank Bird steam-electric generating plant in Billings. Whelchel has been with the Montana Power Co. at Butte since 1950 and previously was in the Great Falls office.

► **James E. McKinnon,** commercial manager and agricultural engineer for the Kootenai Rural Electric Assn. at Coeur d'Alene, Idaho, has been elected mayor of that city.

► **Dick Lacey,** residential salesman for Pacific Power in The Dalles, was his community's Man of the Year for 1960. The winner is chosen annually by a committee from the Chamber of Commerce, Rotary, Kiwanis, Lions and Optimist clubs. Two other Pacific Power employees were also honored by their communities. **Amos Fine,** PP&L representative in Madras, Ore., was named Outstanding Senior Citizen of Jefferson County. **Stan Collins,** Pacific Power manager in Libby, Mont., was chosen by Libby Jaycees as Boss of the Year.

► **Miles O'Malley** has been appointed manager of the Douglas County PUD succeeding **Fred Lieberg.** O'Malley, who joined the PUD eight years ago, has been serving most recently as distribution superintendent. Lieberg held the managership on a temporary basis for several months, and now becomes auditor and chief accountant. **Horace Fleming,** previously manager of the Kittitas PUD at Ellensburg, was made distribution superintendent. **Merton Dick,** who has served as auditor, will continue with the district as recording secretary of the board.

► **Glen E. Sorensen** of Frontier has been elected president of the Wyoming Natural Resource Board, a state agency for attracting industry to the state. Sorensen is president of Kemmerer Coal Co. and Lincoln Service Co., which provides electric power to Kemmerer and surrounding areas.

► Promotion of **H. M. Lind** to the post of chief design engineer was announced by E. Robert de Luccia, Pacific Power & Light Co. vice president and chief engineer. **Joe T. Lienert,** who has headed PP&L's substation design group, succeeds Lind as assistant chief design engineer. The post of chief design engineer was left vacant on retirement of **Bruce H. Aaron,** who had served the company for nearly 37 years.

► **George A. Fleming,** with the USBR for 26 years and in the Sacramento regional office since 1944, has retired. He began in the bureau's Denver office in 1934, and previously worked for General Electric in Schenectady and with Sierra and San Francisco Power Co. and Southern California Edison. While in Sacramento, he was in charge of the power resources planning of many CVP facilities, including the power plants at Folsom Dam and the Trinity River power plant now under construction.

Fleming

► **W. L. Newmeyer,** electrical engineer for the USBR at Denver, retired recently after more than 27 years of government service. He had been in charge of maintenance of the bureau's power developments. Newmeyer served as a member of a United Nations team that visited Greece in 1946 and prepared a report on the nation's power resources. He worked 14 years for Westinghouse in Pittsburgh before joining the USBR in 1933.

► **Richard H. Wood** of Vancouver, Wash., has been appointed assistant administrator of REA, with responsibility for coordinating and directing the program. Before joining REA, he served as chief of the construction division of the Corps of Engineers, Titan missile project at Larson Air Force Base. He was with Bonneville from 1939 to 1956 as construction management engineer and as manager for the western Montana district.

► **Forest H. Garrett,** employee services coordinator at Washington Water Power Co., has retired after 42 years with the company. He started as a clerk in the auditing department in 1919. He later became supervisor of pay roll records and also served as director of employee welfare before taking over the post of employee service coordinator.

► **William Pederson,** Seattle contractor, has been named president of the Northwest Utilities Contractors Assn. Other officers include **Jim Armeni,** vice president; **Arnold Lowe,** treasurer; **Lester Franklin,** secretary; and **John Quam, Jim Hill** and **George Paffile,** trustees.

Deaths

► **Kenneth Laing,** distribution engineer for Pacific Power & Light Co., died recently in a Portland hospital from leukemia. He had been Kalispell, Mont., district engineer for PP&L before his transfer to Portland early this year. He joined the company in 1946 at Pendleton following Air Force service in World War II.

► **Frank G. Hughes,** former operator of Hughes Electric at Glendive, Mont., died at his summer home in Squirrel Island, Me. He moved to Glendive in 1904 and operated the Hughes properties until about 1918 when he sold them to the Eastern Montana Light & Power Co., later the Montana-Dakota Utilities Co.

► **Stuart D. L. Paine,** 51, founder and secretary of Paine Mfg. Co., Northgate, president, Northern California Electrical Bureau and chairman of the board of Thompson & Holmes Ltd., died after a long illness last month. He had been a volunteer on the second Byrd expedition to the Antarctic.

► **Roswell Stanton Belnap,** 60, district manager for General Electric Supply Co., Salt Lake City, was found dead of a self-inflicted gunshot wound in the gun closet room of the New State Gun Club near Salt Lake City May 6. He had been with General Electric since 1926 and since 1950 the Salt Lake district manager of G-E Supply. Previously he had been manager of the Boise branch house of the same company.

► **B. A. McDonald,** retired past president of the International Association of Electrical Inspectors and an author for McGraw-Hill magazines and editor of the IAEI *News Bulletin,* died recently.

► **E. James Mackey,** 43, partner in the E. J. Mackey Construction Co. in Sacramento, died recently. He was for many years in amateur baseball and was active in the organization of youth teams.

► **Louis J. Benedetti,** who has been active in electrical contracting in Washington for the past 50 years, died in Seattle recently. He was past president of Electrical Workers Union 46; past president of the Puget Sound Chapter, NECA; he founded Industrial Electric Co., and was retired chairman of the board of Northwest Electric Co. of Seattle.

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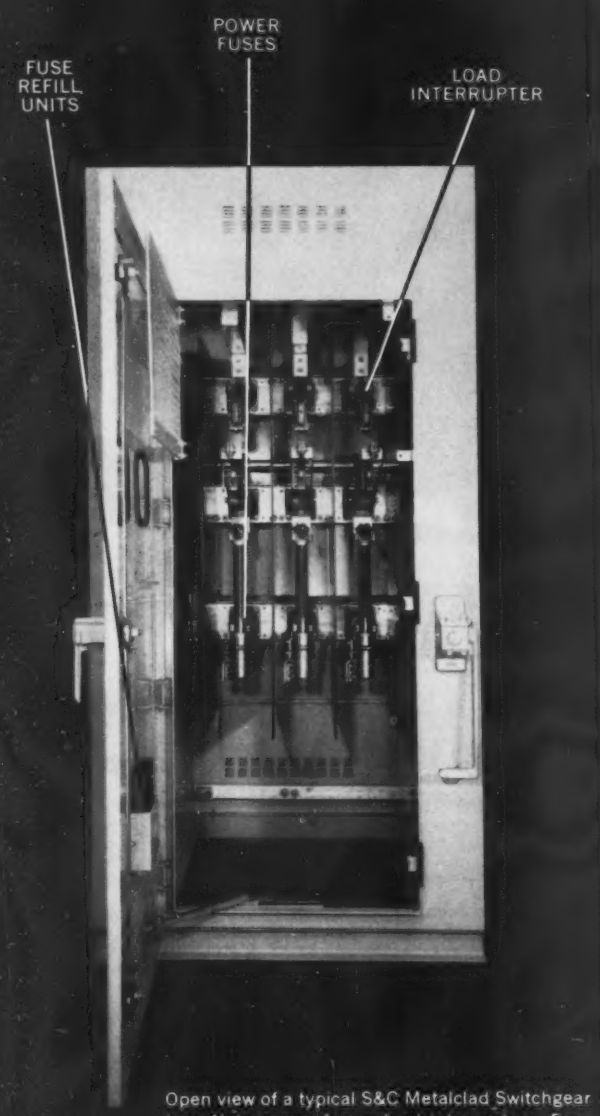

Open view of a typical S&C Metalclad Switchgear bay. Note power fuses, load interrupters. Fuse refill units are conveniently stored in the door.

So why buy this feature in your 2.4 thru 14.4-kv switchgear?

Reclosing is for the birds, squirrels, tree limbs, lightning, icing, windstorms, and kite strings that frequently cause non-persistent faults on open distribution lines of utility systems. Reclosing re-energizes the lines to restore service in a fraction of a minute.

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ELECTRICAL WEST
VOL. 127 NO. 1 JULY 1961

YOU CAN'T HOLD WHAT YOU HAVEN'T GOT

Is the "Maginot Line" of the construction industry—the labor contract—genuinely protecting the market for that industry or isn't it? Electrical contractors have good reason to wonder if infiltration behind and around their first line of defense has captured much of their logical market while they manned the fortifications.

The heat pump market is just another in a long list of markets that aggressive salesmanship might have won. Holding the line with the union, certainly, has not delivered this market into the contractors' hands. It has gone around the end to the refrigeration, the sheet metal, the plumbing and heating contractors. Nor is it likely that restrictive and "loaded" union contracts will ever deliver it back to electrical contractors. Government contracts may be coerced in that way but the general public not only seeks but finds ways to circumvent such coercion. It can be sold but hardly ever forced.

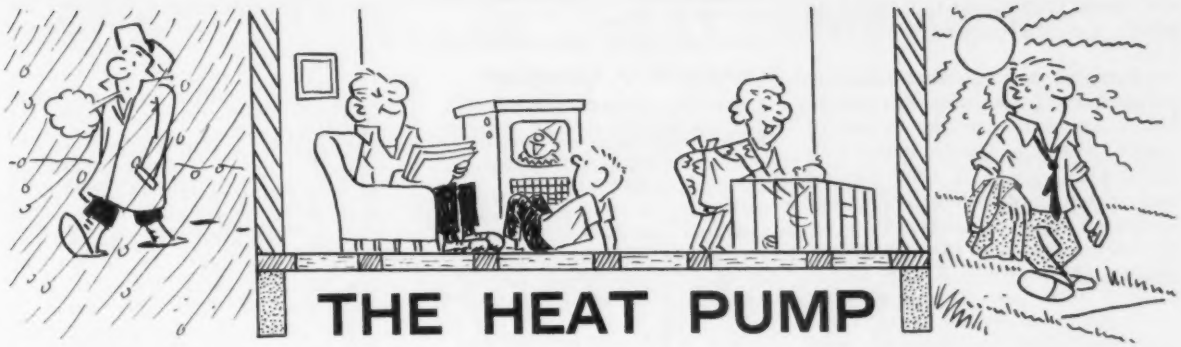
If this were the only market so lost it might not impress anyone. But electrical contractors have lost many of their original markets the same way. There was the appliance market, the electric motor market, the radio and electronics market, the residential lighting market, the luminous ceiling market, the plant maintenance market—to name a few. Rather than push forward saleswise as these marketing opportunities opened up, they withdrew defensively to "protect" them by attempting control through labor monopoly. Others saw the opportunity, had imagination to foresee its potential, and to earn the reward of their initiative and enterprise.

Even the contractors' association, which has led its members into almost total dependence upon union protection, has become aware of late that these efforts were not resulting in capturing and holding the vast market for electrical construction that the growth of the industry and of population has generated. Surveys made recently, while indicating some growth of volume along with total growth, have revealed a decreasing percentage of the total going both to members and to union contractors generally as well as to the union members themselves. While still struggling with legislation at national and state levels to force work into their channel, both union and association are trying to alert their members to the necessity of selling their services lest they lose these markets still more completely.

Some of the association leadership, more enlightened than others, is making a genuine business-building approach to the recapture by salesmanship and service of these lost markets. As they do, they enlist the willing help of the other branches of the industry that are and have been interested in a healthy development of the business.

Oratory at conventions to admonish holding to mythical "channels of distribution" has not accomplished much toward doing so. While these speeches were flowering, others eager for such business opportunities have made channels of their own around and behind the Maginot Lines of the electrical industry and are selling these markets.

Even legislative dictates as to who does what will not restrain the public from giving the business to those who will deliver it totally and effectively and responsibly, no matter what label their business carries.



THE HEAT PUMP

Heat pumps are good for people. They give the user year-round climate control; build a balanced utility load; offer the contractor a profitable business opportunity

The early '50s saw the commercial advent of a new electrical appliance—the heat pump. Heralded as the end-all of comfort heating and cooling, it soared into the market place. Initial installations, while costly, were well engineered and proved satisfactory. Onward to the mass market!

From three or four suppliers the list swelled to 30 or more. Some utilities, alert to power sales opportunities, joined the over ebullient suppliers and oversold the idea. The pressure for volume—the key to low cost production—forced some suppliers to underdesign the units and their controls. Sheet metal contractors rushed to install bargain basement jobs. The upshot: high bill complaints; noise complaints; faulty equipment; fly-by-night installations; underrated applications; and little or no service. In his ire, John Q. Public awarded the heat pump a well deserved black eye.

Through it all there have been individual areas, individual suppliers, individual contractors that have resisted the short cut temptations and have brought the industry to maturity. A single idea separates the good from the bad. *Heat pump systems must be engineered.* This statement includes inspection to assure construction to engineering standards, specification of sound components (of which there are many), and periodic preventive maintenance of what is probably the most complicated system in the home or commercial structure.

The heat pump has arrived—really arrived. Having survived the shake ups and shake downs (the problem of design, service, sales, etc., are not unlike those that confronted the auto industry 40 years ago—or the aircraft industry 30 years ago—or that confront the nuclear industry today), it is ready to offer John Q., humbly, much more automatic comfort, more reliably, for fewer dollars than any other system that promises year round climate control.

Design Trends

A study of the past 10 years reveals clear trends.

1. The most readily discernible trend is that to lower cost packaged units. This trend has been the logical evolution of an industry going from limited production to mass production. Initial productions drew on existing standard compressors, etc., whereas, once a reasonable volume was reached, design of components specifically for the task has enabled manufacturers to cut down the size and, consequently, the cost. Manufacturers advise that savings of this type are nearly at end, that additional production will have a relatively small effect on total cost, mainly for the reason that the cost of the equipment itself is a small part of the complete installation.

2. Larger sized integrated packaged units have become available. These larger units now enjoy the economies of relatively high production, are available for all sizes of homes and commercial installations and are used in combination for all sizes of industrial plants.

3. Another trend in the design of heat pump equipment is to air-to-air equipment. Initial heat pumps used water or the earth as a heat sink. With the availability of large quantities of water limited and construction of the underground heat sink network a costly undertaking, the air-to-air heat pump reduces the total cost of auxiliary systems. Early air-to-air units had difficulties with icing on the evaporator coils, but this limitation has been overcome in most designs. The use of available water and other heat sources in industrial plants is still possible, but not with so-called packaged equipments.

Higher Saturation

Discussions with suppliers, utilities, prospective users and architects yielded four important obstacles in the path of really high heat pump saturation. They are (1) high operating cost; (2) high first cost; (3) maintenance problems; and (4) design and insulation problems. A review of these problems determines their validity.

Operating Cost—One cannot question that the heat pump is an excellent utility company load builder. Since it represents both a summer and winter load, it has excellent characteristics from a utility viewpoint.

How about the users' viewpoint? A utility company, operating in the central band of the country, has done experiments with some 5,000 units, has determined that the average annual operating cost of the residential heat pumps on its system is $150. The homes involved, in the main, were over 2,000 sq ft. Few people can argue that this represents an exorbitant operating cost for winter heating and summer cooling from a cost-of-energy viewpoint. The above figure was computed on

the lowest step of the rate schedule, which was approximately 1¼¢ per kwh.

Where, then, do the high bill complaints come from? Most of the high bill complaints are the result of dead-of-winter, dead-of-summer bills in which the two or three hottest and coldest months have been large compared with pre-heat-pump experience. Another case is where heating previously had been accomplished with gas (clearly cheaper for heating alone in natural gas areas) and there had been no summer cooling. High bill complaints result from heat pump installations that have been inadequately insulated. But an honest comparison of like services reveals the heat pump to be economical.

The Insulation Question

Application of insulation is clearly a must wherever heat pumps are installed. The application of insulation, which is usually a relatively small building cost factor, pays both in the amount of energy required to maintain desired temperatures, and also in the size of equipment necessary to handle peak cooling and peak heating days. It's not unreasonable, because the savings in initial costs offset most of the cost of insulating the homes. *It is a question of how much insulation is necessary.*

The required amount of insulation is a function of the temperature extremes in the area, the cost of power and, to some extent, the viewpoint. For instance, in some areas power companies have recommended overmuch insulation to prevent high bills. On the other extreme, some builders have minimized on insulation, building substandard jobs where operating costs will be unnecessarily high. The accompanying table assumes a simple home situation and demonstrates how heat pump energy savings vary with various thicknesses of insulation in the ceiling, walls and floor. In reading this table it should be noted that this is an energy saving. The fact that the 4-0-2 and the 6-4-0 insulation have a nearly equal saving does not indicate that the cost of *applying* these two systems of insulation would be the same. As a result, it may be considerably cheaper to achieve a given saving by applying insulation in the ceiling and walls only rather than in the ceiling and floor.

Capital Costs—The belief that capital costs are exorbitant also appears to be poorly founded. Heat pump installations in tract-type homes where all the advantages of repetitive manufacture could be brought to bear have been reported at $1,000 and under. Comparable climate control, i. e., both heating and cooling, by separate systems would most likely cost more rather than less than this figure. This is true, in the main, for larger custom-built homes as well. The usual basis for the "Oh my gosh!" reaction to heat pump capital investment is the step from a heating only or cooling only system to a combination of heating and cooling. One other situation where capital costs are not comparable is the situation where gas heating and "swamp" coolers are used. This is not considered a comparable installation however. Thus, if an individual accepts the idea of the need for heating and refrigerated cooling, the heat pump offers no economic disadvantage and, in many instances, it offers a saving.

SAVINGS FROM INSULATION COMBINATIONS IN A TYPICAL 1,300-SQ-FT HOUSE

Conditions: 40 F Temperature difference (70-30 F)
Glass-to-Wall ratio—1:4
Heat Loss (with no insulation)—75,110 Btu per hour

Insulation			Savings in Operating Cost and Equipment Size
Ceiling	Wall	Floor	
4	0	0	32.0%
6	0	0	33.2
4	2	0	44.3
4	0	2	46.8
4	4	0	45.3
4	2	2	58.8
4	4	2	60.0
4	4	4	61.2
6	2	0	45.4
6	4	0	46.6
6	2	2	60.0

Service Problems

The most valid objection to the heat pump comes from trying to get service for ailing equipments. The potential health hazards to small children in an unheated home in winter or the annoyance of an out-of-service cooling cycle during a 120 F day are enough to cause anyone to be "mad at the machinery" when competent round-the-clock service is not available. In too many instances service has been neither competent nor readily available. One manufacturer whose policy is to make major repairs to compressors at its factory (supplying an exchange unit to the customer) found that seven out of ten of the equipments returned for major repairs were in perfect operating condition. The real problem, then, is a screwdriver problem—a loose wire, a faulty relay, or a bad contact.

Prospects for improved service will naturally improve as the saturation of heat pumps increases and refrigeration or heat pump dealers can "set up" the kind and capability of organizations necessary to do the job. Manufacturers are spending a good deal of their sales effort in dealer training and servicemen training activities. In several parts of the country, schools have been set up and this activity is on the increase. To a man, the leading suppliers of this equipment recognize that the size of their market is directly dependent upon their ability to put together competent service organizations to augment their sales efforts.

Design and Installation Problems

As previously mentioned, heat pump systems must be designed for each application. While the design of a satisfactory installation is not a challenging technical assignment, there is a variety of factors (type of installation, amount of window space, type of roof, orientation to the sun) which must be cranked into the calculation in order to get a satisfactory result. Where misapplication has taken place, it has been done on the basis for the previous application of hot air heat where a contractor says, "Most six-room houses in these parts require so many Btus of heating." The misapplications are, in the eyes of competent designers, imbecilic. The units have been placed near bedrooms without soundproofing. Furnace-heating-sized duct work has been specified (in general it takes ducts 50% larger than for heating). Corrosion protection against condensation during the cooling cycle has not been planned. (These are all things that most certainly vanish as the manufacturers build competent sales and service field organizations.)

Utility organizations have sensed that one of their constructive roles is in the area of policing the heat pump market. Several utilities have put together customer check lists which encourage the ultimate owner to check the contractor's reliability, to check his warranty, and to make sure that certain fundamentals of good design have been observed in the design and installation of the new equipment. In one area of high heat pump concentration, the util-

ity, in extreme cases, had to go to the builders in the area and warn them against out of town contractors that came in and made marginal installations which would result in dissatisfactions for the developer.

In summary, while the capital cost for a good heat pump installation is sizable it is less than the equipment required for comparable climate control. Even the operating costs are considered reasonable as a result of the favorable coefficient of performance. The most serious hindrance to really widespread use of this new climate control technique seems to revolve about the development of competent design, installation and service facilities. Each member of the industry should become active in helping this situation. Surely the utility companies can, and in most cases are, offering guidance and assistance in these areas. In many areas, utility companies have drawn together architects, engineers and interested contractors to discuss with them the opportunities and problems inherent in this new method of comfort control. With meetings such as this, they are helping to live down some of the heat pump's earlier black eyes and making constructive recommendations on insulation as well as presenting the facts on operating costs, etc. These forums have proved to be a particularly potent constructive force.

How About Conversions?

Many excellent conversion jobs have been undertaken in residential and commercial buildings. Here again, the requirement for the careful design approach is required. There are lots of pitfalls. For instance, many of the older buildings do not have insulation and are subject to high operating costs. Additionally, where the ducting is minimal from the point of view of heating, it is inadequate to supply the required volume of cooling air and the performance of the unit is unsatisfactory. Also in regard to the ducts, there is a possibility that, where uninsulated galvanized ducting has not been used, there will be condensation problems, which will cause the existing ducts to rust. To serve this conversion market, some of the manufacturers have created evaporators that fit over the existing gas furnace so that the existing furnace blower can supply the air over the evaporator and into the cooling ducts. Wherever the volume of air available from the blower and the ducts is satisfactory, this proves to be an excellent practice.

HEAT PUMP ABCs

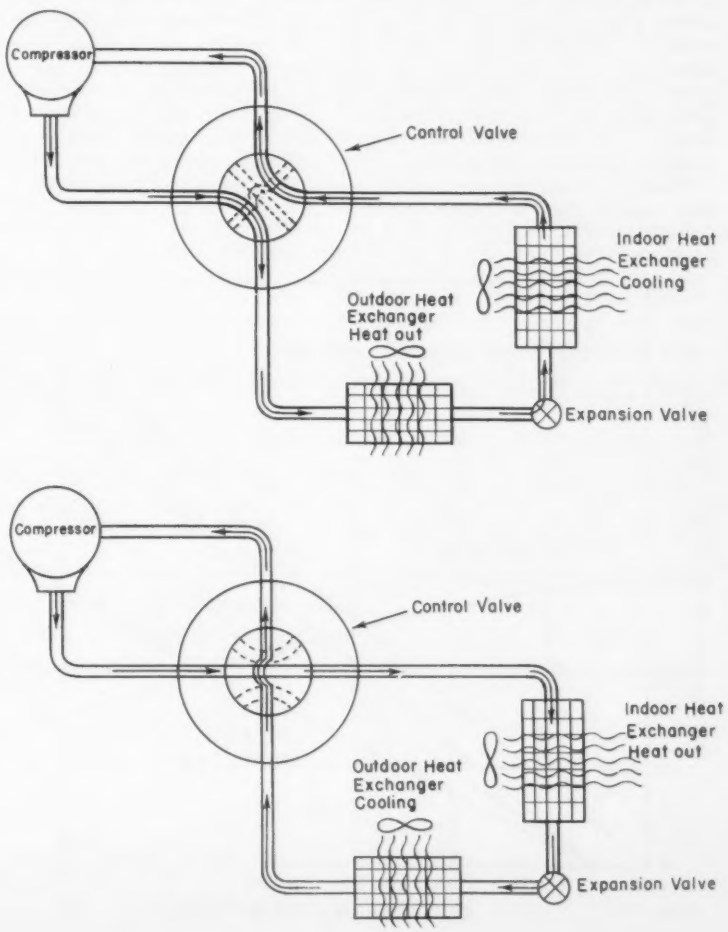
Heat Pump—A refrigeration cycle machine that moves heat in either direction. As such it becomes a heating or cooling device depending on its application and control.

Coefficient of Performance—The heat pump moves heat rather than creates it. The COP is the ratio of the useful energy obtained to the energy required to pump the heat from place to place. The COP varies with ambient temperature from a high (in the order of 3.4) at high temperatures to a low (1.5) at low temperatures. A COP of 3 means that 1 kwh of pumping energy delivers 3 kwh of heat. The COP is one of the keys to heat pump economy.

Heat Sources—All substances contain heat until they reach absolute zero. Heat pumps are usually classified by the heat source medium and the heat sink medium. Hence the air-to-air heat pump takes heat from the air and discharges it to air. After air, water is the most common source. Using air or water heat exchangers, heat may be extracted or dumped to the ground or in a variety of industrial processes.

Split Systems—A unit in which the compressor and one heat exchanger (evaporator or condenser depending on heating or cooling cycle) are located remotely from the heat exchanger which supplies the desired heating or cooling. Split systems are advantageous where space or noise or availability of an external heat source may cause limitations.

This block diagram of air-to-air heat pump shows how control valve reroutes the refrigerant, changes role from heating to cooling



COMPARATIVE OPERATING COSTS

The heat pump is compared with electric resistance heating, with gas and with oil in this study of fuel costs in typical Western cities

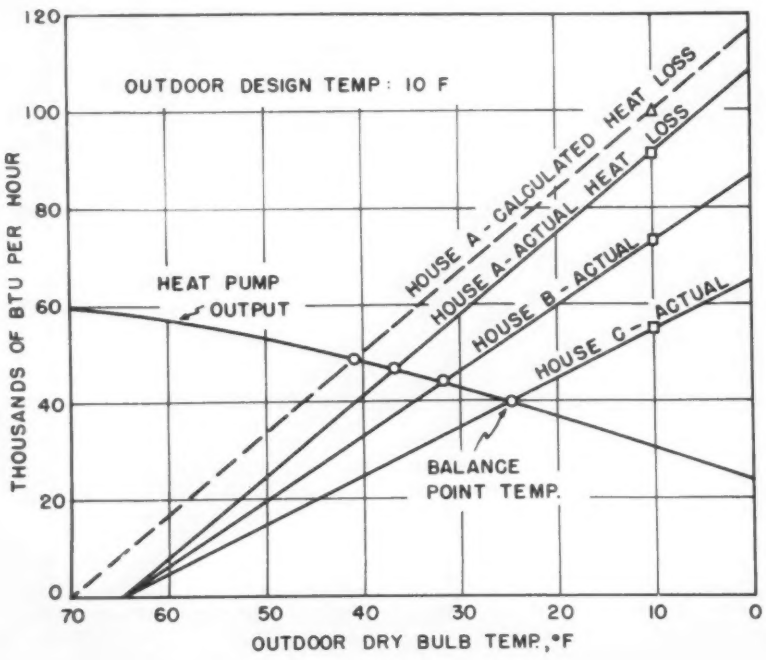
DR. STANLEY F. GILMAN, UNITARY PRODUCT ENGINEERING DEPARTMENT, CARRIER CORP.

Methods are available for estimating operating costs of coal, gas and oil equipment. Why are they not applicable, with slight modifications, to the heat pump?

To answer this, it is necessary to consider the characteristics of the air-source, electric-driven heat pump, which is simply a refrigeration machine used to supply heat to a space. A typical performance curve for a heat pump is shown in Fig. 1. Note that the heating output is not constant but decreases as the outdoor dry bulb temperature decreases. In contrast, the heating output of a gas or oil furnace is the same regardless of the outdoor temperature; that is, a furnace rated at 80,000 Btu per hour always delivers heat at approximately that rate to supply the amount of heat needed by the residence; it merely operates for longer periods during colder weather.

Therefore, one characteristic of a heat pump that is different from conventional oil, gas or coal heating systems is that its heating output varies with the outdoor temperature; that is, it is a function of the weather.

A heat pump sufficiently large to handle the heat loss of a house in the coldest weather will generally be oversize for the summer cooling requirement. It is both economical and practical to select the unit on the basis of the cooling need and add electric resistance heaters to make up the heating deficiency during short periods of cold weather. The efficiency of a heat pump is considerably greater than that of electric resistance-type heaters; hence, to predict the total power consumption of the system, it is necessary to estimate the amount of heat supplied by each of the two devices. These separate amounts, however, are a function of construction of the residence and its geographical location.



In Fig. 1, curves A and B represent the heat requirements of two houses as a function of outdoor temperature. The balance point temperature is the outdoor temperature at which the heat pump output is just equal to the house requirement. House A has a greater heat loss under design conditions than house B; hence, its balance point occurs at a higher outdoor temperature, 32 F vs 25 F. Within these temperature limits, part of the house A requirement is supplied by resistance heaters, whereas the house B heat is supplied entirely by the heat pump. During the time the outdoor temperature is between these limits each Btu supplied to house A will cost more than that to house B. Consequently, the time-temperature history of the locality must be considered in predicting operating costs.

In summary, the performance characteristics of a heat pump-resistance heater combined system are dependent on the outdoor temperature existing at a given time. Hence, prediction methods for gas and oil heating systems are not applicable and special procedures must be developed for residential heat pumps.

The operating cost prediction problem can be divided into two parts:

1. What is the total Btu requirement of the residence for the heating season? This is a function of the size and construction details of the residence (heat loss) and its geographical location (weather). Note that the Btu requirement is independent of the heating system; hence, this phase of the problem requires the same information whether the fuel be coal, gas, oil or electricity.

2. How much does it cost annually to supply the Btu requirement of item 1? This is a function of the efficiency of the heating system and the unit cost of the electrical energy.

Only in the case of the heat pump are items 1 and 2 interrelated; the

Fig. 1 — Calculated and actual heat loss

TABLE 1 - RELATIVE ELECTRIC COSTS

(COMPUTED TO NEAREST DOLLAR — DEMAND CHARGES NOT INCLUDED)

Electric Rate	Phoenix		Sacramento		Portland	
¢/Kwh	Heat Pump 3,600 Kwh	Electric Heat 8,400 Kwh	Heat Pump 6,100 Kwh	Electric Heat 14,600 Kwh	Heat Pump 10,900 Kwh	Electric Heat 21,200 Kwh
.5	$18	$ 42	$ 31	$ 73	$ 55	$106
.75	27	63	46	110	82	159
1.00	36	84	61	146	109	212
1.25	45	105	76	183	136	265
1.50	54	126	92	219	164	318
1.75	63	147	107	256	191	371
2.00	72	168	122	292	218	424
2.25	81	190	137	329	245	477
2.50	90	210	153	365	273	530

weather pattern influences not only the house requirement, but the efficiency of the heating system as well. A prediction method taking these factors in mind has been reported (reference 1*)) and was used to develop the cost data presented below.

To give some feel for the relative operating costs of different types of heating, and especially of the operating costs of heat pumps in residences, a house design was selected for analysis. This house was then placed in three different cities, namely, Phoenix, Sacramento and Portland, a heat pump selection made and operating costs computed and compared with other forms of heating.

The Home

The home chosen was 1,500 sq ft in floor area (30x50 ft) with medium weight side walls incorporating 1 in. of insulation, with 4 in. of insulation in the ceiling. The floor was a concrete slab poured on the ground with standard recommended edge insulation around it. The single-pane windows had a total area of 25% of the gross wall area.

*1. S. F. Gilman and W. Clausen "Predicting Annual Heating Costs of Residential Heat Pumps." ASHRAE Journal, Vol. 1, No. 5, p 52, May 1959.

The Climate

The cities of Phoenix, Sacramento and Portland were selected as typifying the various climates in the West Coast region.

Phoenix is representative of a hot, arid region with a mild winter climate. The cooling design temperature is 105 F and the winter is 25 F. The daily range of temperature is quite large, being about 30 F. Phoenix is at 35 North latitude and 1,100 ft above sea level. It has 1,700 heating degree-days based on a 65 F datum.

Sacramento has a milder summer and a more severe winter than Phoenix. The cooling design temperature is 100 F and the winter design is 30 F. The daily range of dry-bulb temperature is 18 F and it has approximately 2,800 heating degree-days. It is at a latitude of 39° and is about 100 ft above sea level.

Portland, Ore., is in what would be termed a temperate climate; hence, very little summer cooling is required. The cooling design temperature is only 90 F, but winter design is 10 F. Typical of sea coast areas, the daily range of dry-bulb temperature is small, being about 18 F. It is at latitude 46° at sea level, has 4,600 heating degree-days, or 2.7 times as much as Phoenix.

Heat Pump System

For residences, the accepted procedure is to select the air-source heat pump to match the design cooling load with the cooling capacity of the unit. In most localities and homes, the heating capacity of the heat pump is not sufficient to supply the heating requirements during colder weather. As a consequence, supplementary heat, usually in the form of resistance heaters, is ordinarily installed to make up the deficiency (see Fig. 1). Therefore, since this home would have a large cooling load in the hotter climate of Phoenix than in the temperate area of Portland, the heat pump unit would be of different size in the three cities, although located in a house of the same construction.

In the three cities being considered, the cooling loads are approximately 3, 2½ and 2 tons of air conditioning in Phoenix, Sacramento and Portland, respectively. The significance of this is that the heating capacity of the heat pump in the Portland residence will require supplementary resistance heating at a somewhat higher outdoor temperature than in the other two cities. This points up the statements made previously that it is necessary to consider both the heat pump system and

TABLE 2 — RELATIVE FOSSIL FUEL COSTS

(COMPUTED TO NEAREST DOLLAR)

Gas Rate ¢/Therm	Phoenix 450 Therms	Sacramento 780 Therms	Portland 1,140 Therms	Oil Cost ¢/Gal	Phoenix 350 Gal	Sacramento 600 Gal	Portland 870 Gal
5	$23	$ 39	$ 57	10	$35	$ 60	$ 87
6	27	47	68	11	38	66	96
7	31	55	80	12	41	72	104
8	36	62	91	13	45	78	113
9	41	70	103	14	48	84	122
10	45	78	114	15	52	90	131
11	50	86	125	16	55	96	139
12	54	94	137	17	59	102	148
13	59	101	148	18	62	108	157
14	63	109	160	19	66	114	165

the locality when considering system performance and operating cost.

Heating Costs

Results of applying the reference 1 operating cost prediction procedure yield annual heating kilowatt-hour requirements for the heat pump were as follows:

Phoenix	**3,600 kwh**
Sacramento	**6,100 kwh**
Portland	**10,900 kwh**

The significance of the greater need for electric resistance heating in colder climates is indicated by the fact that although Portland has 2.7 times as many degree-days as Phoenix, it requires slightly more than three times as much electric power over the heating season.

Calculations were also made for straight electric heating as well as gas and oil heating. Results are shown in Tables 1 and 2 in terms of dollars of seasonal operating costs for various rates.

Another factor influencing relative electric costs is a demand charge that some utilities apply. It is, therefore, desirable to maintain the total system demand as low as possible. Table 3 shows the computed demands for the selected heat pumps in the three cities. Since resistance heaters are applied in fixed increments of capacity, the values in the table are minimums. As would be expected, the demand increases as the winter design temperature decreases. The heat pump demand ranges from 60% to 70% of that required for the completely electrically heated home.

TABLE 3 -- WINTER DEMAND

Sacramento	Phoenix	Portland
	Heat Pump*	
6.7 kw	7.9 kw	10.5 kw
	Electric Heating	
11.2 kw	12.5 kw	15.0 kw

*Includes compressor, fans, resistance heat.

The above operating cost and electrical demand data apply to the 1,500-sq-ft home described early in the article. However, all data can be extended quite accurately to larger or smaller homes of equivalent construction by proportioning the square feet of floor area. This is to say, a home two-thirds the size would have approximately two-thirds the listed electrical demands and operating costs. Also, the tabulated data apply to the selected home in other localities having comparable climates.

A UTILITY LOAD BUILDER

In recent years Western utilities have been experiencing peak loads during the summer caused by summer pumping loads and the increasing use of air conditioning.

Looking for methods to smooth out these summer peaks, they have found a great potential help in the heat pump. This unit can, with the same kilowatt input, give peak summer cooling and winter heating, thus creating a steady load.

Meanwhile, internal heat sources in schools, restaurants and industrial and commercial buildings have risen tremendously. Lighting, machines, sun load through large glass areas have increased the internal heat to the point where cooling is required even in temperate climates where cooling was not considered at all 10 years ago.

An analysis of the capital costs involved in installing a heat pump system is very simple. Once it is assumed that some form of cooling will be installed it can be said that the cost per ton for a standard air conditioning unit will just about equal the cost per ton of a heat pump. Thus, the heating plant is free and the economic study shifts to the matter of fuel costs.

Pacific Gas and Electric Co. made a study of a hypothetical single-story California contemporary office building and worked out some figures it felt would be useful and adaptable to other situations. It chose three different floor areas, 5,000, 10,000 and 100,000 sq ft. It was assumed the lighting loads and density of occupancy would be normal and that the design temperature would be 35 F.

It was recognized in this study that capital costs were largely dependent on the architect's design and the physical location of system components. Also, based on operating costs alone, electric-driven equipment was selected as the most logical type to consider.

Using the present worth concept, the company was able to draw the following conclusions:

For the 5,000-sq-ft building there was a $6,550 saving in cost if a heat pump was installed, but a $132 annual energy charge was incurred over and above the annual energy charge for an air-conditioner-gas furnace combination. The present worth concept allowed the company to say that a saving of $6,550 in capital outlay would give it $570 per year for increased operating expenses. This assumed a 6% interest rate on money and a 20-year equipment life.

As noted, the increased annual energy charge over and above energy costs for a furnace-air conditioner combination was only $132, meaning that a heat pump was not only economically feasible for installations in San Francisco but actually would save the purchaser money. Excluded from the analysis were maintenance costs, which would seem to favor the heat pump, because maintenance should be the same as on a straight air conditioner.

A summary of the results of this study applied to the various sized buildings appears in the accompanying table.

There is an additional feature of the heat pump that gives it an advantage over a conventional fuel-fired heating system so far as economics is concerned, that is, the heated air exhausted from a building can be passed over the heat collector of the heat pump and the heat content can be recovered.

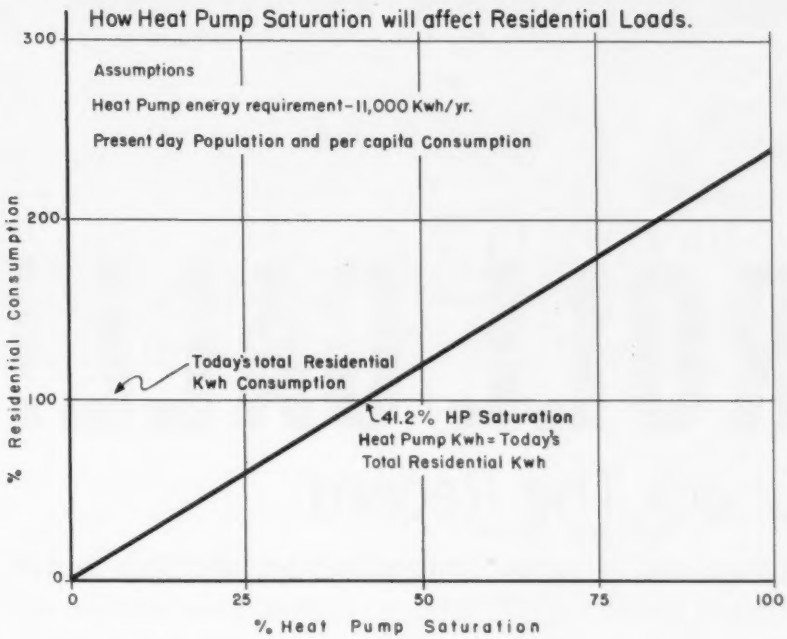
With local ordinances now requiring four or five air changes per hour in restaurants and other public buildings, this method of heat recovery gives the heat pump a definite advantage. This heat recovery, as well as the internal heat sources – people, lighting, machines –in most instances will take care of the question of back-up heaters.

So far only the economics of the heat pump have been discussed. It

ESTIMATED SAVINGS USING COMMERCIAL HEAT PUMP

(1) Building Size (Sq Ft)	(2) Capital Saving Using a Heat Pump	(3) Annual Value of Capital Saving	(4)* Increased Electric Costs Using a Heat Pump	(3-4) Estimated Annual Net Saving to Owner Using a Heat Pump
5,000	$ 6,550	$ 570	$ 132	$ 438
10,000	$ 13,634	$ 1,280	$ 103	$1,177
100,000	$122,000	$10,600	$1,217	$9,383

*This column is obtained by subtracting the annual operation costs of a gas heater-electric air conditioner combination from the operating costs of a heat pump.



does have other advantages which might include:

1. A year-round system of air conditioning with a reversible cycle instantly available for either heating or cooling.
2. The same equipment serves for cooling or heating, giving undivided maintenance and operating responsibility.
3. The heating boiler is eliminated, thus eliminating its cost, the space it would occupy and the fuel.
4. With the heat pump there is no fuel delivery or ash disposal problem.
5. With smoke abatement regulations becoming increasingly stringent, the heat pump eliminates the air pollution problem.
6. With a definite upward trend in the cost of fossil fuel and the relatively level cost curve for electric energy, heat pump plants are expected to show a progressively greater saving as time goes on.

Residential Use

Although many hesitate to predict saturation figures five and ten years hence, utility sales managers generally are optimistic about the future of the heat pump in the home. Those willing to make an educated guess put 1970 saturation as high as 65% where climate is particularly favorable and as low as 1% where there is little demand for summer cooling. The majority placed their estimates between 5 and 12%.

Fifteen of the 26 representative utilities queried by ELECTRICAL WEST are pushing residential heat pumps actively and an additional eight are promoting on a "limited basis" or are including heat pumps along with other electric heating in the Gold Medallion program. These utility promotions include special sales campaigns, advertising in all media, consumer booklets, personal calls and, in some cases, wiring allowances and help with financing.

A favorable note for the future is the fact that "nature's air conditioning," a strong competitor in some areas of the West, is beginning to seem less adequate. Reports from Puget Sound and San Diego (where residential heat pumps were prominent in the recent Spring Fair) indicate that customers who have enjoyed climate control in downtown buildings or in an apartment want it in their homes.

Also favorable to increased sales is user satisfaction expressed in utility surveys. In Las Vegas where Nevada Power promotions have built a high saturation (see p 2), 91% of the customers surveyed were pleased with their installations. A survey of 44 residential heat pump customers in Southern California Edison territory uncovered only five criticisms and they were minor. For the most part customer comments ran: "only thing to use"; "finest thing that ever happened for the homeowner"; "wouldn't be without a heat pump." Operating costs were mentioned as "low" in a number of instances.

Residential sales managers have had their share of the problems mentioned earlier in this report. The cure, they believe, is education, which is essential to get (1) qualified people to install and maintain the units; (2) good engineering and realistic sizing for the job; (3) users who understand the equipment and how to operate it (too many people, they say, look upon the heat pump as just another refrigerator, or expect it to act as a quick recovery unit).

Utilities are doing their part in this educational job, devoting engineering man-hours to field advisory service; distributing consumer booklets that tell the story in language the homemaker can understand; conducting industry meetings and classes. Last May 160 people from 57 firms attended a PG and E heat pump seminar in Fresno. Similar industry meetings have been held previously in Fresno and in Bakersfield. A 12-lesson course put on in Sacramento by SMUD and a committee of manufacturers and distributors enrolled 264 people before registration was closed because the auditorium could not accommodate all who wanted to attend.

However, despite a definite improvement in some areas there is a way to go yet, the utilities believe. Good refrigeration men to guide electrical and mechanical contractors, service organizations in every city to give guaranteed maintenance are among the needs cited by individual executives.

The intent is to insist on quality and utilities are supporting dealers on that basis. It can be summed up in a comment by the residential sales manager of one of the first utilities to promote the heat pump: "Yes, we are still going after residential heat pump business but we are doing it with a rifle instead of a shot gun."

Report continued on p 64

ROLL CALL!

Check The Record

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ELECTRICAL WEST
JULY 1961

CONTRACTING & CONSTRUCTION SECTION

STATISTICS / COSTS / PROPOSED PROJECTS / NEW PRODUCTS / NEWS

LATE NEWS FLASHES

Service Shop Feud

That the official position of Electrical Apparatus Service Assn. (formerly NISA) barring General Electric and Westinghouse from advertising in its EASA News or exhibiting at its annual convention at the Jack Tar Hotel, San Francisco, June 11-14, was not the unanimous opinion of all members was demonstrated in the floor action during the business session of the convention. After a report by William Wheeler, New York, as chairman of the Small Business Protective Committee, gathering case histories of abuses by the two manufacturers' service shops which has resulted in action to investigate them by the Federal Trade Commission, a motion to negate the official stand of the directors came to the floor and was hotly debated. Although tabled the incident showed that the boycott on the manufacturers' advertising was not favored by all independent shop owners, even if by the majority. (Story next month.)

Chris Klawa New Oregon Chief Inspector

To succeed W. R. Volheye, who retired as chief electrical inspector for Oregon, his assistant, Chris Klawa, was appointed as chief by Oregon's Bureau of Labor, under which state electrical inspection is conducted. Klawa, prior to joining Volheye in 1956, was an electrical inspector for Portland for 21 years. Leslie F. Lynch will become the assistant chief for Oregon.

Housepower Forums in Southern California

More than 250 enrolled in the Housepower Forums conducted by Southern California Edison Co. in conjunction with its promotion of the Medallion Home drive throughout the area it serves. The 6-lesson course of EEI, especially designed to help electrical contractors sell Medallion Home wiring, supplements efforts to upgrade local wiring ordinance adequacy requirements.

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78 READER SERVICE SECTION

How come an all-electrical device with a big future is being sold and installed now principally by a variety of nonelectrical enterprisers? Why aren't the electrical contractors in this fast growing

HEAT PUMP BUSINESS?

Is the electric heat pump market, like so many others that were the electrical contractors' for the selling, **lost to them now?**

Is it worth while to take another look at its potentials and make a belated but energetic fresh start?

What's been going on with this electrical combined heating and cooling device that has taken it away into other fields?

Our survey and some field trips over much of the prime area for this reverse cycle equipment gives some uncomfortable answers to these questions. To put them bluntly:

1. **All is not yet lost,** but mighty close to it, as far as what is generally known as the electrical industry is concerned.

2. **It can be had** by any far-sighted electrical contractor who organizes his business to sell, install and service it. But he must mean it, not just toy with it.

3. **This market so far has been snatched out from under his doze** by other trades and crafts who are aggressively selling it. They are his competitors, not electrical contractors.

Like the luminous ceiling business and the kitchen modernization business, which electrical contractors also are in danger of losing, the heat pump business overlaps other craft fields. And some of these other craft fields have pretty nearly taken it over.

It is not sold satisfactorily to a customer as a piecemeal thing. The fuss of separate deals with a half a dozen crafts kills it for the customer. He wants it sold and delivered as a package. And the electrical contractor, if he wants to be in that business, must be the prime contractor — the general — and take under his own wing the craftsmen other than electricians that he needs for this specialized business. So far, what heat pump business electrical contractors have done has been as subcontractors to a refrigeration or a sheet metal or plumbing contractor. All they have done has been merely to connect the motor to the service. Contractors to be in this business themselves must reverse this situation and be the producer.

Of the contractors of all types who are presently doing the heat pump business, the sheet metal contractors probably predominate. Refrigeration contractors come next in numbers and then plumbing and heating contractors. Electrical contractors are at the tail of the list. In many cases they may subcontract to do the run of conduit to the compressor motor and even connect up the controls but that is all. Yet it is by far the least part of the total business. Hence it carries the least financial return.

Where the installation involves a two-piece unit, one inside, the other outside a house, naturally there is more of an electrical job. At the maximum, where a new service is required because of increased capacity needed, the electrical portion would be about $300 in proportion to a sheet metal contractor's $150 to $200 for duct work. Where the unit derives its heat or dissipates it from a water source, the plumbing portion of the job would become more of a factor.

Why many electrical contractors shun heat pump business in total is the involvement in labor jurisdictional beefs that may arise. Workmen from each of these crafts are necessary, plus that of refrigeration machine repair and service. Conceivably a good all round mechanic could do the complete installation job. None of the electrical, plumbing or sheet metal skills required are complicated. However, the craft unions, if the contractor runs a union shop, are jealous of their work jurisdictions.

Because of this labor situation, many of the smaller contracting firms doing heat pump business and air conditioning operate nonunion. For those that operate union, the size and volume of business must be such as to justify the contractor keeping employed a union electrician, a union plumber, a union tinsmith and a refrigeration mechanic. He must operate as a general contractor (in California under a C-20 license). The successful heat pump contractors do just this or else sublet the electrical or plumbing or sheet metal, as the case may be, to others, acting as the contractor themselves.

This permits them to offer the ultimate consumer a complete installation package at a total price. No piecemeal offering to the customer is ever satisfactory. The selling contractor should assume full responsibility to deliver a completely operating job to the user. To do this he must handle all the intercraft business as well as the procurement of the equipment, financing and servicing.

Service is the most important factor to provide for in the operation of a successful heat pump business. While the equipment of the major manufacturers is well built and should operate with a minimum of service, the sale of a heat pump does obligate the seller to deliver satisfactory performance over a reasonable length of time. And when it does need some adjustment or part replacement, the customer wants to be able to go back to the man who

sold and installed it in the first place. Service is part of the business. It cannot be shrugged off. Where this has happened the business has received a black eye, justifiably so.

With hermetically sealed refrigeration units and well-built equipment, the service aspect of the business is not a real deterrent. Facilities are being set up in many areas now for the repair and rebuilding of even these hermetically sealed units. Rebuilt units are available for replacement or trade in for the one needing repair. With hermetically sealed units most service calls come from need for control adjustments.

Distributors and manufacturers of the best makes hold service training schools or classes to assist the heat pump dealer to get or train qualified men. Such men should be selected for their adaptability to service work and kept on it. It is a mistake to depend on the regular electrician to run out and make a service call when his work is predominantly in the construction field. He does not know what to do quickly. He does not like it. And in the busy time when service may be needed, that man may very well be tied up on a construction job.

Another excuse contractors give for not being in this heat pump business is this very preoccupation with new construction. Few contracting establishments today, especially in the competitive field, are set up either to sell or manage service and modernization work. They have no available manpower for such work. Even the union cannot interest its members in training themselves to work in service shops when there is overtime and a high pay defense or big construction job in prospect.

As a result the growing volume of such specialties as electric heating, heat pumps, modernization, is being taken over by others—either other craft contractors or by nonunion. Both NECA and IBEW have been trying to alert their members to this diversion of their market.

The heat pump business, in a few words, is available to contractors who go into it as a business in itself, not a mere sideline. It requires a selling approach, not a labor protective one. The public is ready for it and other crafts are selling the heat pump to the public in increasing volume. The electrical contractor will have to fight to win it back, but his weapons will have to be salesmanship and superior service.

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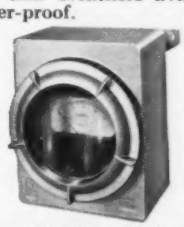

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PACKAGED UNITS OR CENTRAL STATION

An analysis of the problems encountered in selecting packaged or central station equipment for heat pump installations

R. E. JAPHET. PRODUCT SALES MANAGER, COMMERCIAL HEAT PUMP SALES, WORTHINGTON CORP.

In any evaluation of the relative merits of the packaged vs central station-type heat pump, all the problems confronting the engineer in the selection of a standard air conditioning system will apply. And, a few additional points may be added concerning the over-all building and its operation.

1. Aesthetic appearance of the building.
2. For a large single-story building the roof may have to be reinforced if packaged units are to be mounted on it.
3. Floor space requirements for central station equipment.
4. Service cost of the multiple unit installation including inspection vs that of central station equipment.
5. Sound generated by the equipment.
6. Operation cost of electrical consumption per unit of cooling.

It is assumed here that the project under consideration can economically justify the installation of heat pumps, and our purpose is to discuss the merits of packages vs central station equipment. In so doing, particular attention must be paid to the following points.

1. Equipment cost
2. Power consumption
3. Equipment life
4. Inspection and service

System Comparison

Three types of systems will be contrasted for a single-story shopping center requiring 300 tons of refrigeration.

A. Twenty 15-ton split packages; outdoor sections roof mounted; indoor sections ceiling suspended.

B. Four 75-ton commercial split air-to-air heat pumps with four outdoor units roof mounted and four multizone units floor mounted.

C. Two 150-ton commercial split air-to-water heat pumps with four outdoor units roof mounted and eight air units floor mounted.

Heat Pump Equipment Cost

Budget pricing in dollars per ton of cooling is shown in the accompanying graphs. These prices depend on the make of equipment, local union rates and particular problems of the project under consideration. They can, however, be used for comparisons of the types of systems when no unusual circumstances have to be considered. Such use will show:

System A—$117,000
System B—$142,000
System C—$138,000*

* Under "C" the cost of the air units and water piping has been excluded.

It becomes evident that package units have an advantage in initial capital cost. However, other factors should be considered in a complete evaluation.

Floor Space Requirements

System A—None
System B—1,000 sq ft
System C—1,200 sq ft

The floor spaces listed are approximate and depend on the make of equipment. The figures speak for themselves and favor packaged equipment beyond doubt.

Roof Loading

System A—50,000 lb approximate
System B—18,000 lb approximate
System C—18,000 lb approximate

It should be noted that the load is spread as follows:

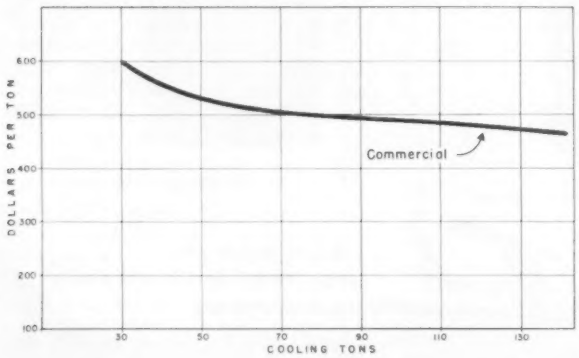
System A—All over the roof

System B—At two selected locations of building—9,000 lb per location

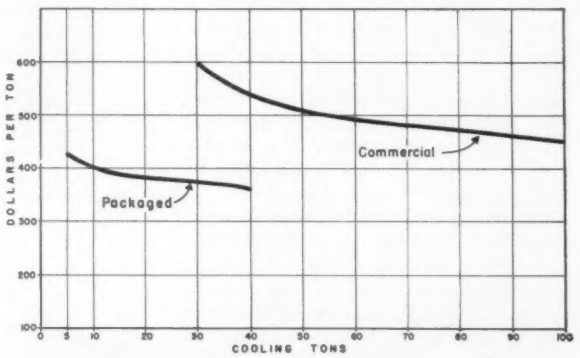
System C—At one strategic position selected by the architect and engineer.

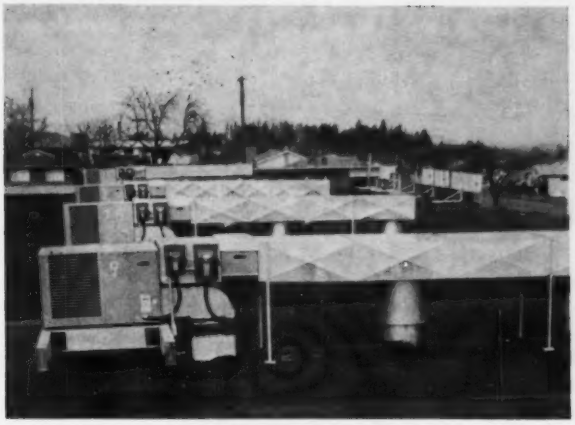
If the packaged equipment load imposes additional problems in the construction of the roof, the price of this reinforcing would have to be added to the cost.

ESTIMATING PRICES—AIR-TO-AIR HEAT PUMPS. Packaged prices include split packages wired, installed and charged. Commercial units include split commercial packages with interior air units, installed, wired, insulated and charged. Duct work excluded

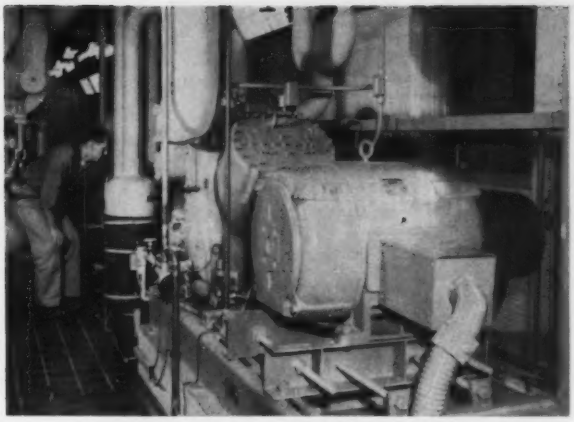


ESTIMATING PRICES—AIR-TO-WATER HEAT PUMPS. Commercial units include split commercial package, installed, wired, insulated and charged. Air units and water piping excluded. Prices in all curves are based on dollars per ton of cooling





PACKAGED HEAT PUMPS mounted on roof are less expensive to install and save valuable floor space but consume more power



CENTRAL UNITS give finer control and can make use of excess heat in one portion of the building to condition a cooler area

Electrical Consumption

Basically, heat pumps operate in three seasons of the year: (1) summer; (2) winter; and (3) fall and spring. The latter two are classified as one season because of their similar temperature ranges. In order to evaluate electrical consumption, these three conditioning seasons must be analyzed separately.

Summer—In the summer season, a heat pump will operate in the cooling cycle and will either be fully or partially loaded, depending on the outdoor temperature and the interior building requirements. When proceeding with the analysis of the three systems, the following power figures can be assumed when fully loaded.

System A—400 kw, air-cooled condenser

System B—290 kw, evaporative-type condenser

System C—310 kw, evaporative-type condenser

The substantially higher power consumption of the packaged equipment is due to the lower efficiency of the smaller hermetic compressor and air-cooled condenser.

It is impossible to predict accurately the power consumption of the system when partially loaded. It can only be stated that: system A will have many units cycling on-off, giving a varying electrical load; system B or C with step unloading will give steady load.

System A, due to its simpler but poorer control, will cycle on-off depending on the control settings. No steady temperature can be maintained. So, it can be assumed that during unloaded conditions the power consumption will be slightly worse than that of a steady unloaded system such as B or C.

Winter—In the winter the power consumption figures are nearly equal, as no high outdoor ambient temperatures affect the packaged system. Regardless, the hermetic compressor does not improve its efficiency, and in general terms System A will consume 10-15% more power than B or C when fully loaded.

Fall and spring—It is well known that the intermediate seasons as well as the mild winter days often require simultaneous cooling and heating. The perimeter of a building may require heating even with surplus heat existing in the interior. Unless extra provisions are made, the package units serving the interior of the building will operate on cooling and the perimeter units will operate on heating, thus consuming full power. The central station equipment, if properly designed, will take full advantage of this situation and simultaneously heat and cool although the machinery will be partially unloaded. Power savings under these conditions may run 50% or more with an effective means of operation.

To sum up power consumption is a hazardous task and only a **rough estimate** can be made. This tabulation is based on arbitrarily assigning the value of 100 to the power consumed by the packaged equipment.

	Summer 15 weeks	Winter 15 weeks	Spring & Fall 15 weeks
System A	100	100	100
System B	75	85	50
System C	80	90	60

Evaluating these figures over one year of operation would indicate central station equipment may save 30% of the kwh consumed per year.

Life of equipment is a controversial subject and depends entirely on the quality of the manufactured item and the care and maintenance that is given to it. No real statistical data is available to date on heat pumps as the subject is relatively new, but with improved technology and manufacturing techniques the life of central station equipment can be estimated at 15-20 years and that of packaged equipment 7-10 years.

The financial aspect of the life span is left to the reader but it obviously favors the central station equipment. Replacement of parts such as a coil or a valve is easier on the more accessible central station equipment than on the packaged units, which are extremely compact.

Inspection and Service

A 300-ton air conditioning system and consequently a heat pump installation, be it packaged or central station, should be serviced to prevent trouble and to prolong life. The nature of a central station installation requires a serviceman of high caliber who really understands the installation. He may be more expensive than one checking the packaged units. On the other hand, the time consumed in servicing 20 packaged units spread over a large building and inspecting the ceiling units and changing their filters may compensate for the difference.

It appears safe to assume that the service costs may run a little higher for central station equipment in the first three years; the next two years all systems will cost about the same; and thereafter the packaged system will be more expensive to maintain —the cost rising year by year as replacements become more frequent.

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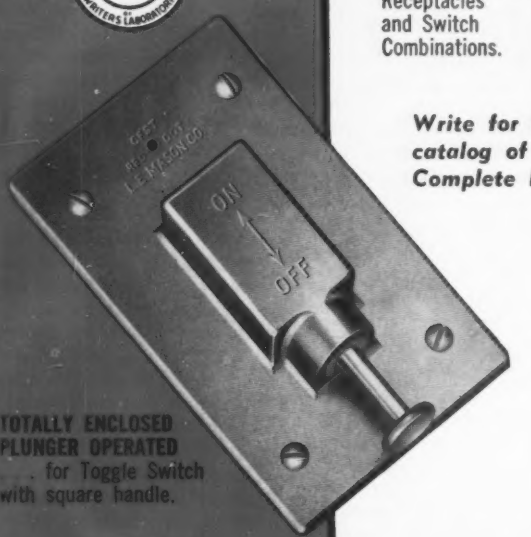

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ELECTRIC HEATING CALCULATIONS

Some facts and figures on many of the advantages to be gained and the pitfalls to be avoided when figuring electric heat

HOWARD S. SMITH, POWER SALES ENGINEER. COLORADO CENTRAL POWER CO., ENGLEWOOD, COLO.

Many in the electrical industry are not familiar with the wonders that electric heat can perform. They don't realize, for example, that electric heating is at its best when individual room control is achieved—both from an economical and a comfort standpoint. With individual room control in well insulated homes the thermostat senses the heat present in the room. For example, when a child enters a bedroom to study and turns on 200 w of light the thermostat senses this heat plus the child's body heat of 100 w plus. If the bedroom heat loss is 1,000 w, this then becomes 30% of the heat at design temperature and would provide all the heat required at 30% design temperature difference. This condition occurs in every room of the home. Appliances will add to the heat in certain areas — even the heat from ironing. Another important source of heating is the sun. Southern windows offer the greatest amount of heat from this source. Individual room thermostats will sense and make use of this important source of energy.

Just how much do these sources of other energy produce? Records on the home of Floyd Olson, president of Solar Electric Heat & Insulation, Salt Lake City, Utah, indicate it is more than 8,000 kwh per year.

Consider All Sources

Industry Standards

The electric heating industry has based its standard on ceiling insulation of about 6 in., wall insulation 3½ in. and floor insulation 3½ in., assuming a law of diminishing returns for insulation over and above this standard. They have overlooked the constant free heat factor generated in a home whether it is well insulated or poorly insulated. Calculations will show that a reduction in heat loss by one-third from 9 w per sq ft to 6 w per sq ft cuts the heating cost 50%. It will also be noted that a reduction from 18 w per sq ft loss to 6 w per sq ft will reduce the fuel bill 80%, disproving the assumed law of diminishing returns for insulation.

Improve Heat Loss

What can be done in the average 1,200-sq-ft frame brick veneer home to improve the heat loss and provide economical heating costs?

Assume a 30x40-ft home with two 3-ft by 6-ft 8-in. doors, 200 sq ft of glass and crawl space at −10 F design temperature.

Table I gives calculated heat loss for this hypothetical home with various amounts of insulation.

Insulation Does It

With good insulation practice and control of air infiltration with storm windows, etc., the heat loss may be reduced to 27.7% by superinsulation as compared to normal insulation.

If there is a 6,000-kwh free-heat component, the purchased kilowatt-hours would be 6,000 for the super-insulated home as compared to 37,200 for the normal insulated home, or a ratio of 6.2 to 1. This is the

TABLE I

Degree of Insulation	Total Watts Loss	Watts Loss Per Sq Ft
1 Air Change Per Hour		
3-in. ceiling insulation	25,897	21.58
10-in. ceiling insulation	24,577	20.48
10-in. ceiling insulation and 5½-in. wall insulation	18,577	15.48
½ Air Change Per Hour		
10-in. ceiling insulation, 5½-in. wall insulation, storm windows and doors	13,881	11.57
10-in. ceiling insulation, 5½-in. wall insulation, storm windows and doors and 9½-in. floor insulation	7,161	5.97

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TABLE II

MAXIMUM RELATIVE HUMIDITIES TO AVOID CONDENSATION ON INSIDE OF GLASS

(70 F INSIDE TEMPERATURE: STILL AIR)

Outdoor Temperature (Degrees F)	Windows With Single Glass	Windows With Tight Storm Sash
−30	2%	40%
−20	5%	43%
−10	8%	46%
0	12%	49%
10	18%	52%
20	24%	55%
30	32%	58%
40	43%	61%
50	58%	64%
60	75%	67%

approximate fuel cost ratio, electric vs gas, in the Denver area; thus, real economy can be realized in the electrically heated home.

Plus Features

Now that we have discussed the economy of electric heat with super-insulation, let us consider other important features of such a home.

Storm windows offer added livable area near the windows in areas where outside temperatures are below freezing. They also offer the possibility of healthful humidity, as shown in Table II.

Table III indicates the temperature of various materials if the inside temperature is 72 F and the outdoor temperature is 0 F.

In a well insulated home the air temperature can be reduced, thus reducing the amount of heat loss through the walls. Let's see why this is so.

One heating theory states that when the air temperature plus the average surface (ceiling, walls and floor) temperature is equal to 140°, that human comfort is achieved. Based on this theory, a super-insulated home with storm windows will be comfortable at 6° to 10° lower air temperature. This means less heat loss through the walls, ceiling and floor, adding somewhat to the economy of electric heat with better insulation.

Electric heat can be economical even in areas with low natural gas rates. The further advantages of individual room control, cleanliness, safety and real comfort can make it an outstanding plus value to any home.

Individual Comfort

TABLE III

	Temperature of Inside Surface
Single glass window	17°
Double glass, ¼-in. air space	42°
Double glass, ½-in. air space	45°
Triple glass, ¼-in. air space	52°
8-in. hollow concrete block wall	47°
Frame wall, no insulation	63°
Frame wall, 1-in. insulation	66°
Frame wall, 2-in. insulation	67.6°
Frame wall, 3⅝-in. insulation	68.9°
Frame wall, 5⅝-in. insulation	69.7°

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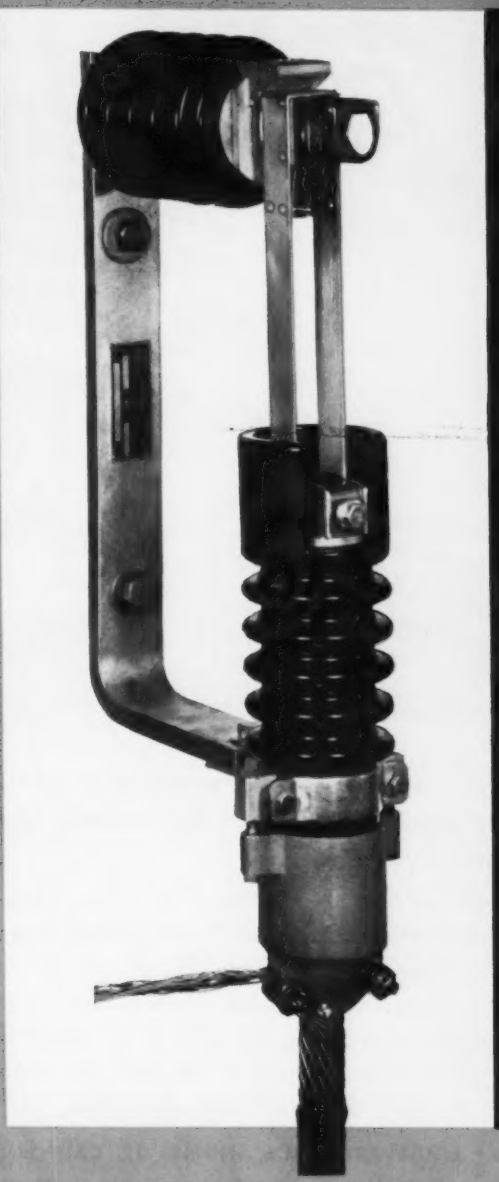

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Motors and Controls — XXIII

SOME PROS AND CONS

TOM HUGHES, CALIFORNIA DEPARTMENT OF INDUSTRIAL SAFETY

We have encountered mostly resistance and indifference from individuals handling motors and controls as we have pursued our ideal of a coordinated system in the last few years. So let's first study the criticisms and then take up the long list of assets.

Practically the only real criticism of inherent motor protection (as motor men call it) is that once your device takes the motor off the line you are really shut down. Since the device is sealed up inside the hot motor you have to wait for that motor to cool down before you can use your control circuit again.

These critics point out that a stalled motor has lost the cooling effect of its built-in fan. If you want to get that motor going you will have to hunt up a portable fan and cool it down before you can start it. While, under the present system, they point out that you can soon reset the overload relay and get the motor on the line again. Its own fan will then cool it down as it runs. All this, of course, if you give it a chance to cool down.

Now they have been dealing with nuisance tripping as its incidence has gradually expanded through the years. Nuisance tripping has become an accepted fact before World War II but a lot of people have changed their opinions of such inefficiency since then. However, with inherent motor protection, this isn't just nuisance tripping: this is murder. By the time some penny-wise-pound-foolish owner has had to wait a half hour for a motor to cool down to restart-temperature the motor manufacturer will learn that he has sold his last motor in that plant.

Ten years ago, the motor salesman had a good point there. So you can see why the producers of motors preferred to wait for some intelligent plant engineer to make a special order of motors with inherent protection. But we have tried to show that the present state of automation is just about ready to eliminate these irresponsible cost-conscious operators of small factories.

One of three things will happen: they will forget cost and aim at dependability in all components; or they will go crazy; or they will be forced out of business. And we don't mean maybe. It is just around the corner and this should be a warning to the electrical contractors whose sole hope of remaining in business is to underbid their competition.

Be that as it may—we have tried in these articles to get over the prime postulate that, regardless of what kind of motor protection we are considering, it is just to be used as a last resort in the event of unexpected mishap. Any discussion of nuisance tripping is just debating over something that we say should not be allowed to exist. So we don't consider this a valid criticism of our coordinated system.

Nevertheless, there are a few cases where the owners don't want even emergency tripping because it can cause mechanical mix ups. Then the inherent thermal sensors can be used only to produce suitable warning. A fire pump is a good example. If you were fighting fire and the protector gave warning of motor overheating you could pinch the discharge valve back a little and reduce the head without shutdown.

Fire prevention and code authorities may question the use of warning in lieu of shutting down the motor but there are many motor applications (such as cooling water pumps) in refineries and factories where the sudden unexpected shutdown of the motor would create ten times as much hazard or destruction as an eventual winding burn out would. Naturally, it is assumed that a warning setup would not be employed unless there is normally an attendant within reach of the warning. It would then fall to his discretion.

It is also possible that in some very peculiar cases, nuisance tripping may be excusable and it is imperative to get the motor running again (lightly loaded) so it can cool itself down. In that event a momentary contact button could be used to shunt out the shut-down action of the inherent protector. The attendant would have to hold this button in until the motor cooled enough for the warning to cease. Thus he would be there in sight of the motor if it started smoking.

Well, so much for the criticisms. Now, going back over the long list of problems with motor protection let's compare notes. Our relatively insolvable problems of overvoltage and single-phasing are conquered because we have a sensing device applied to each phase. This device doesn't care about voltage or power factor because it responds to heat—not to current flow.

If the motor is improperly applied by someone and hot spots are developed by frequent starting, abnormal recycling or any other form of heat producing performance, the motor is protected. If something happens to shut off the motor's air supply our sensing device is just as much on guard. Of course, the difference in ambient between controller and motor location is no item.

The sensing unit must be properly chosen for the winding of a particular motor and once that is accomplished the ambient temperature does not alter its ability to shepherd that motor. The exterior components of the control system are essentially the same for all motors and one does not have to carry a large supply of different size heaters or overload relay coils.

There is the one exception where certain thermostat or thermistor setups require augmenting with a high-speed overcurrent relay (either thermal or magnetic). Such a relay would have to be inserted in the motor current leads and all our concerns with remote overload relays (such as ambients and abnormal voltage conditions) would apply, to a lesser degree. But the need for such augmenting would depend on the type of motor and duty. The Guardistor and the Tri-Clad 55 series of motors do not need augmenting under any circumstances, according to their manufacturers.

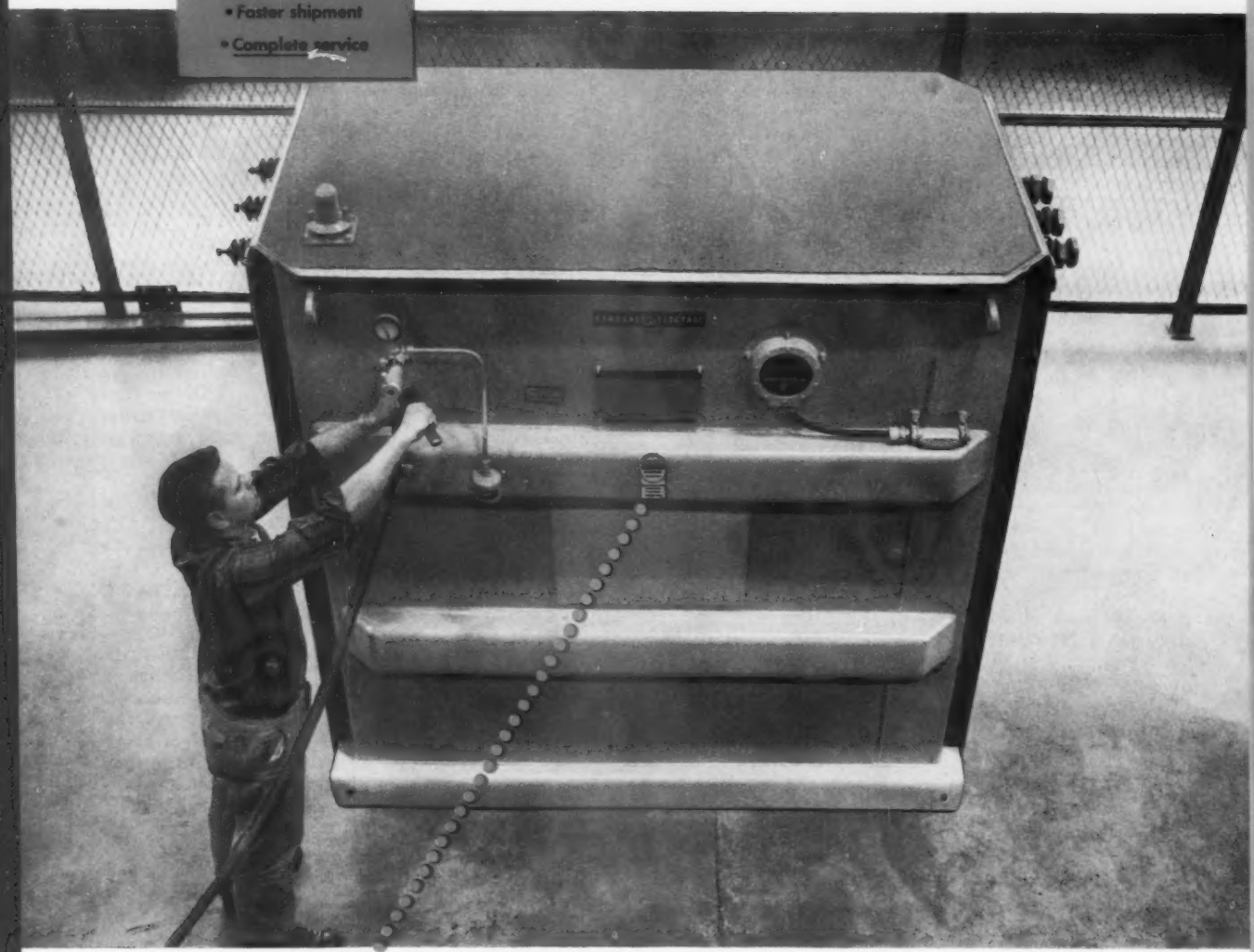
Since the heat-sensing elements are applied by the manufacturer and sealed up in the winding or motor case, the user is not inclined to tamper with them or use the wrong heater elements as is done in the present systems. Of course, he can always by-pass their operation in the exterior control circuit if he wants to. There isn't anything electrical that can't be rewired to modify its operation.

Any of these inherent motor protectors can be coordinated with any complex control circuit. They are really simple, foolproof systems that require no special technician to maintain. Most of our latest gadgets are coupled with electronics and one is faced with having an electronics technician available for trouble shooting. But not these systems. Anyone that can check out a control circuit and catch an "open" holding coil can trouble shoot these.

FULL-VALUE
CERTIFIED
TRANSFORMER
GENERAL ELECTRIC

- Superior design, features, and performance
- Faster shipment
- Complete service

NEW sealed gas coolant



SYMBOL OF FULL VALUE

With this seal, General Electric certifies full value for your transformer dollar; full value in terms of superior basic design, features, and performance . . . plus faster order handling and shipment . . . plus complete service before, during, and after installation. No other transformer manufacturer can match this complete General Electric package.

dry-type transformers feature for higher insulation levels

General Electric gas-filled units are as much as 30 percent lighter, smaller than previous designs

Use of a new gas—C_3F_8 (Perfluoropropane)—improves heat-transfer characteristics, increases insulation levels, and permits reduction in size and weight of General Electric 15-kv and below sealed dry-type transformers. This new gas has all desirable features of previously used nitrogen . . . plus these added advantages:

- Basic impulse insulation level is significantly higher for all ratings—up to 90 percent above dry-type standards for the 15-kv class.
- Higher insulating properties of C_3F_8 permit size (and, therefore, weight) reduction of sealed dry-type transformers.
- Extremely stable under normal operating conditions, C_3F_8 is non-toxic and non-flammable.

Plus proved construction features

Alpholite* insulation — Inorganic, non-aging, and non-combustible, this insulation has high mechanical and dielectric strength.

Silicone impregnation of entire core-and-coil structure improves short-circuit strength.

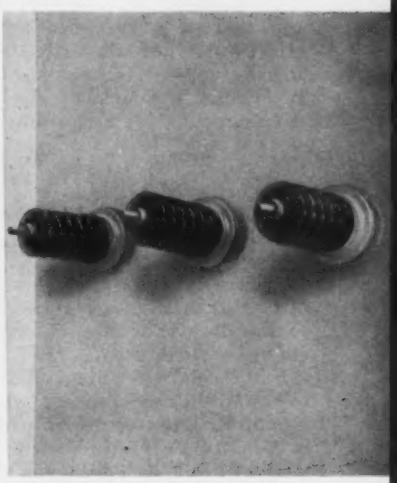
All-welded internal connections give "continuous conductor" construction, eliminate loosening of joints by normal heat cycling.

Terretex high-voltage insulation—This refined, inorganic asbestos material is impregnated with acrylic-ester resin and bound with glass wrap.

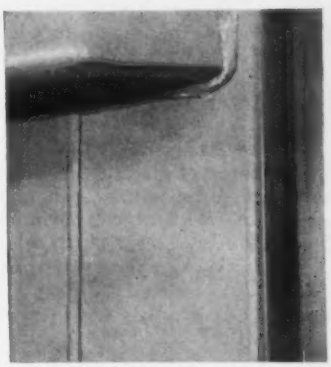
For more information on superior General Electric gas-filled sealed dry-type transformers, contact your General Electric Sales Engineer or Agent. General Electric Co., Schenectady, N.Y.

*Trade-mark of General Electric Company. 417-11

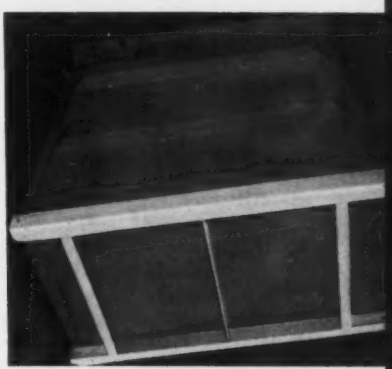
ACCESSORIES include pressure gage, over-, under-pressure device, and diagrammatic nameplate.



HERMETICALLY SEALED BUSHINGS provide more positive tank seal.



SUBMERGED-ARC WELDING on tank seams, bracing, and flanges provides more uniform welds.



NEW FORMED BASE permits rolling, skidding transformer for installation ease.

Progress Is Our Most Important Product

GENERAL ELECTRIC

For phone number of closest representative see advertising index in back of book.

MANUFACTURERS AND DISTRIBUTORS

► Appointment of **James F. Hrabetin** as executive vice president of **Gough Industries** was announced by Mrs. P. G. Gough Sr., president of the firm. Gough sold its imported car division last month and is reorganizing the remaining electrical supplies and electrical appliance wholesale distributing divisions. Hrabetin was formerly general manager of the supply division, and his appointment fills a post that has been vacant for the past two years. The firm has branches in Bakersfield, San Diego, San Bernardino and Phoenix. Head office is in Los Angeles.

Hrabetin

► **Sierra Electrical Corp. has bought** out all of the rights, inventories and tooling for the Square D low-voltage control system, according to Lee T. Bordner, Sierra president. According to Square D, that company wishes to remain in manufacture only of products more closely allied with industrial control and distribution. Sierra, on the other hand, is active in the manufacture and distribution of residential wiring fittings and equipment. All engineering manufacturing equipment will be moved from the Square D facility at Cedar Rapids to California.

► **Electric Supplies Distributing Co.,** San Diego has held a Manufacturers Exhibits and Tool Show featuring displays of equipment by the manufacturers represented by them.

► **Angus-Campbell,** 4417 S. Soto St., Los Angeles, will handle the full **Westinghouse** line of insulating materials. The firm is one of the first distributors appointed under a nation-wide plan for expanding distribution.

► **Wayne C. Wells** Co. is representative in the Pacific Northwest for Light Warden, an automatic recharging emergency lighting system made by **Electric Cord** Co.

► **Dale Brown** has set up a manufacturers' sales agency at 1735 S. 23rd East St., Salt Lake City 8, where he represents Sunbeam and Century lines. He recently was with the J. R. Christensen Co. and prior to that with General Electric Lamp Department.

► **General Cable Corp.** has moved its Los Angeles quarters to 2933 S. Supply Ave., Los Angeles 22, T. B. Jones, district manager, announced.

► **John G. Corrin,** Pennsylvania Transformer Division, McGraw-Edison Co., representative, is now located at 415 S. June St., Los Angeles 5.

► **The Globe Co.,** manufacturer of cable trays and other metal products, has announced the appointment of **H. J. Randolph Co.** with offices in El Monte, Menlo Park, Phoenix as distributor for southern California, southern Nevada, Arizona, New Mexico and west Texas.

► Formation of a new heating and air conditioning consulting service department by Wesco division of Northwest Foundry & Furnace Co. at Portland was announced by **W. R. Pindell,** general manager. **Edmund F. Kugel** will head the department. The new service is for architects, engineers and dealers in the Pacific Northwest and applies to the company's new central forced air electric furnace and other products.

Kugel

► **Patton & Cooke Ltd.,** manufacturer of electrical equipment in the medium voltage range, has opened an office at 689 Denman St., Vancouver, B. C. C. Lloyd Patton and H. W. Cooke at one time were with Cemco Electrical Mfg. Co. Ltd. and more recently were with Federal Pacific Electric of Canada.

► **Norman Rupp** Co., manufacturers' representative, has moved from 103 S. W. Front Ave. in Portland to 0112 S. W. Pennoyer St. The company represents Brook Motors, Janette Electric Mfg. Co. and McCauley Industrial Corp.

► **Westinghouse Electric Supply** has opened a new branch in Tucson at 1938 E. 18th St. The 5,000-sq-ft building contains office and warehouse space and will handle apparatus and supplies and portable appliances as well as other lines. E. L. Casey, former resident salesman, will be manager of the new branch working under W. E. Hurford, Wesco's Phoenix manager.

► Under a licensing agreement between **Aluminum Limited Sales** and **A. B. Chance** Co. covering conductor accessories, the Canadian firm will supply Alcan designs and manufacturing techniques to Chance for manufacture and distribution in the United States. Production of the Alcan conductor accessories will expand the Chance product line, which had gross sales last year of $19,821,000. Aluminum Ltd. had not entered the conductor accessory field in the United States previously.

► **Allen-Bradley** Co. has appointed **Capital Wholesale Electric** Co. as its distributor in the Sacramento area. This distributor is being serviced in Sacramento by a branch of the Campbell & George Co. of San Francisc for the manufacturer's complete line of motor control products.

► **Mechanical Equipment Supply** Co., 938 Kohou St., Honolulu, has been named exclusive distributor for **Fedders** Corp. in Hawaii. The firm is headed by Francis F. Sen.

► **Jack Cook** has been appointed sales manager at Capital Wholesale Electric Co., Sacramento, of which he has been a salesman.

► **Thomas M. Hushen,** manager of the General Electric Co.'s apparatus service shop in Salt Lake City, was recently promoted to manager of the New York shop. He has been manager of the Salt Lake City shop for the past two years and will be succeeded by Dee P. Patterson who joined G-E in 1946.

► **Peck-Lewis Corp.,** 4436 Long Beach Ave., East, Los Angeles 58, is now authorized distributor for Micro Switch electrical and electropneumatic safety trip controls.

► **Tal Agencies** has been appointed sales representative in Washington, northern Idaho and Alaska for **Keystone Mfg.** Co., maker of electrical wiring installation equipment. Headquarters are at 1041 Sixth Ave. South, Seattle 4.

► **M. A. Bannister** was named Rocky Mountain area representative for **Valley Mfg.** Co.'s steel lighting pole division. Address is 8741 Oakwood St., Westminster, Colo.

► **Glo-Quartz Electric Heater** Co. Inc. has shifted its southern California operations from Los Angeles to Pasadena. A branch of Glo-Quartz of Willoughby, Ohio, the firm markets industrial heaters, ovens and controls. New address of the branch operation is 188 N. Berkeley Ave., Pasadena. President is George T. Strokes.

► **Edwards** Co. has transferred **William H. Kresge** from Des Moines, Iowa, to the West Coast as Pacific district manager. He will be responsible for overall sales of the company's lines in southern California, Arizona, Hawaii, and parts of Nevada. According to R. L. Kempton, marketing vice president, the appointment is part of Edwards' new marketing organization, which includes eight major districts.

Kresge

► Intersite cable contract for the Montana Minuteman project has been awarded to **Ets, Hokin & Galvin** of San Francisco. The amount of the contract is $8,642,000. It calls for the laying of 2,100 miles of buried cable connecting each of the missile launchers with its launch control center and the entire complex to Malmstrom Air Force Base near Great Falls. Cable will be buried 36 in. deep or more when required. The network will make 34 river crossings.

► **Brand-Rex Division,** American Enka Corp., is expanding its production facilities in California. A new 40,000-sq-ft plant being built in Gardena is expected to be in operation this month. Cabling and cold process jacketing presently housed in the Santa Monica plant will be transferred to Gardena and integrated into newly created production operations.

► **Electro Lighting** Corp. has announced appointment of **Bill Horning Sales** as its representative for Washington, Oregon and parts of Montana. Horning Sales is located at 902 Friedel Ave., Vancouver.

► **Hal Silvernail,** former field sales representative for **Hotpoint** refrigeration department, has been transferred to Denver as general manager, Hotpoint sales department, **Western Appliance** Corp. Western Appliance is independent Hotpoint distributor for the company's full line of appliances and covers the Colorado and New Mexico territory. Silvernail joined Hotpoint 16 years ago in the West Coast regional marketing operation, and later became Western advertising and sales promotion manager with headquarters in San Francisco. He went with Graybar in San Francisco in 1948 as advertising and sales promotion manager and rejoined Hotpoint in 1950 as a zone manager in the San Francisco district. He joined Hawaiian Electric Co. in 1958 as appliance sales manager and returned to Hotpoint in 1959 as field sales representative in the refrigeration department.

► **Design Guild Manufacturing** Inc., has taken display space for its home lighting products in the Los Angeles Home Furnishings Mart at 1933 S. Broadway. **Ernie Owens** is in charge.

► **Allied Electric Motor Service** has been named an Allis-Chalmers distributor in Fresno and Madera Counties in California. The firm, located at 3805 Ventura St., Fresno, will handle industrial controls. **Sal Rome** and **John Nesper** are partners in Allied Electric.

► **Mummert-Dixon** Co. of Hanover, Pa., has purchased Keystone Aerial Ladder division from H. K. Porter Co. Keystone was formerly operated by Delta-Star Electric Division.

► **Halo Lighting Products** has announced new appointments in the West: sales representative for Utah and Idaho, **J. W. Reynolds,** 375 Andrew Ave., Salt Lake City 15; district sales representative for northern California, **William Richardson,** 3342 Taraval, San Francisco; sales engineer for southern California, **Gerald P. Jones,** 1044 Richmond, Los Angeles.

► **Speedster** Inc., Denver manufacturer of special purpose industrial heating elements and institutional electric cooking equipment, has been acquired by **Dorsett Electronics** of Norman, Okla.

► **Plans to construct a West Coast plant** have been announced by McQuay Inc., Minneapolis. The firm will build a manufacturing facility at Visalia, Calif., to produce air conditioning, heating, refrigeration and ice making equipment. Harold T. Hunt has been named plant manager and will supervise construction and layout for the Visalia plant.

► **Wallace Ross** has been named Northwest region electric heating specialist for G-E's Electric Comfort Heating section. With a home office in Seattle, he will be responsible for working with builders, electrical contractors, utilities and distributors in the States of Washington, Oregon, Idaho and Utah.

► **McCarron Electric Co.** has moved into a new 20,000-sq-ft plant in Monterey Industrial Park near Los Angeles. The facility will be used for the manufacture and distribution of relay coils, transformers, copper windings and other products for the electrical and electronic industries.

► **Anaconda** has moved its Los Angeles office to 2626 Malt Ave.

► **Joe H. Shelley** has joined Western Power Products at Portland as vice president with headquarters at 2765 N.W. Nicolai St. The firm is a manufacturer's agent, serving the Northwest states. A 1950 graduate of Oregon State College, Shelley has served as sales engineer in the Northwest with Westinghouse Electric Supply and Reynolds Metals Co. and also been with W. R. Grasle Co.

Shelley

► **National Electric** Division, H. K. Porter Co., has moved its Los Angeles office to 6900 E. Elm St.

► **Harvey Aluminum** has appointed Allen B. Carpenter Co. as sales representative for its line of rigid conduit. The Carpenter offices are located at 1314 Wazee St., Denver, and 211 S. 2nd West, Salt Lake City.

► **C & S Products** Co. of Windsor Locks, Conn., has appointed John T. Hill and William M. Rambo as representatives for Semper-Seal, a new epoxy-type cable splice and blocking compound. Hill and Rambo offices are at 420 S. Pine St., San Gabriel, Calif. The company will serve southern California and the State of Arizona.

► **Dee P. Patterson** was named manager of G-E's Salt Lake City apparatus service shop. His office is at 301 S. 7th West St., Salt Lake City, Utah.

► **Air Engineering** Co., a division of American Electric Co., has been named Pacific distributor for products of **Typhoon Air Conditioning.**

PRODUCT INFORMATION SERVICE

For fast action in securing the manufacturers' literature listed below simply circle and mail the postpaid card opposite. Use the same card to obtain more information about the new products described on the following pages. This Electrical West service is intended as an aid in keeping product files current

CIRCUIT BREAKERS—For complete details on its Pushmatic breakers and panels BullDog Electric Products Division of I-T-E offers its "Pushmatic Pocket Guide." *Circle No. 11.*

ALUMINUM TOWERS—Additional information on the design and fabrication of aluminum towers is available from Aluminum Co. of America in its bulletin 873-F. *Circle No. 12.*

PULLING LUBRICANT—Electro Compound Co. invites you to write for descriptive literature on its lubricant for aluminum conduit. *Circle No. 13.*

VOLTAGE REGULATOR—General Electric Co. has a new bulletin 456-05 describing its controlled regulator switching. *Circle No. 14.*

LOW-VOLTAGE SWITCHGEAR—Complete specification on its Powermaster type AKD-5 low voltage switchgear is offered by General Electric Co. in its bulletin GED-4269. *Circle No. 15.*

NYLON SAFETY STRAP—Mathias Klein & Sons has recently issued bulletin No. 560 describing a complete line of nylon safety straps. *Circle No. 16.*

STEEL CONDUIT—Alcoa offers more information on Rome rigid steel conduit in its bulletin RCP-940. *Circle No. 17.*

TENSIONER—Ask for catalog TSE-1 and Petersen Engineering Co. will send you full data on its line of tension-stringing equipment. *Circle No. 18.*

CONDENSER TUBES—Phelps Dodge Copper Products Corp. has introduced a high-strength copper-nickel alloy tube and will send you complete information in bulletin 2D. *Circle No. 19.*

CABLE SUPPORTS—Need information on trays for power and control cables? P-W Industries will send its catalog 858-A. *Circle No. 21.*

EMT—Republic Steel Corp. describes its complete line of electrical metallic tubing in its bulletin A-1685-A. *Circle No. 22.*

TRANSFORMERS—A complete description of RT&E's Terra-Tran with wide-angle doors is offered in this company's bulletin 100. *Circle No. 23.*

PAINT—Thinking of painting? Subox Inc. will be glad to send you a color card and its technical bulletin No. 7 with full details. *Circle No. 24.*

POWER PIPING—Midwest Piping will furnish you complete information on its piping erection services for power stations and industrial processing plants. *Circle No. 25.*

CORROSION INHIBITOR—If your motors or controls go out of service due to moisture or dust, perhaps you need Corrosion Reaction Consultants' formula 2.26. *Circle No. 26.*

TOOLS—Ideal Industries Inc. has a free contractor and electrician catalog giving details on all of its electricians' equipment. *Circle No. 27.*

WEATHERPROOF BOXES—Bell Electric is offering a complete catalog on its line of weatherproof covers and boxes. For a copy *Circle No. 28.*

INSULATORS—Bulletin TIA-182 from General Electric Insulator Department describes the new Locke line post insulators incorporating wide wire grooves, higher mechanical strength and a special modern seal. *Circle No. 29.*

BUS DUCT—100-amp bus duct is described in an eight-page bulletin offered by Westinghouse, Standard Control Division. This booklet shows how the benefits of conventional bus duct can be secured for installations where smaller blocks of power are used. Drawings show construction and fittings available. *Circle No. 31.*

DISTRIBUTION CENTERS—General Electric's bulletin GEA-7222 describes the company's integral distribution centers with liquid-filled transformers, 112½ kva and above, and dry-type transformers, 300 kva and above. *Circle No. 32.*

CABLE—Data on cables insulated with Okonex butyl-base high-voltage insulation are available in a 48-page manual offered by the Okonite Co. *Circle No. 33.*

PRISMATIC FIXTURES—Weatherproof prismatic wall brackets and ceiling fixtures for residential, commercial and industrial exteriors are described in a new catalog issued by Stonco Electric Products Co. For catalog PB61, *circle No. 34.*

LIGHTNING ARRESTER—Revised bulletin LA2 on Line Material lightning arresters gives application features and ordering and dimensional information on three types. Included are types E5 direct connected rated 1 through 20 kv, S5 direct connected rated 27 kv and 30 kv, and T5 externally gapped rated 3 through 18 kv. *Circle No. 35.*

SWITCHGEAR—Features, maintenance and installation of G-E's outdoor enclosures used with metal-clad switchgear are covered in bulletin GEA-7190. Five steps in the eight-hour installation are detailed. *Circle No. 36.*

TRANSFORMERS—Operating and maintenance features of the Endur-All distribution transformers are given in a bulletin from Allis-Chalmers. A new design is said to reduce impedance by as much as 25% and new locked core and coil construction eliminates 32 pieces of hardware. The unit is 10% lighter and lower. For bulletin 61B9943, *circle No. 37.*

PAINT—Subox is offering three new catalogs: No. 61A, giving technical features of lead-suboxide, Pb_2O_2 as used in metal protective paints; No. 61B, showing colors for rust-inhibitive primers and finishes used in heavy industrial areas as well as self-priming, one-coat paints for metals; No. 61C, listing 10 deep tone colors and 10 pastels with rust-inhibitive lead-suboxide bases. *Circle No. 38.*

BALLAST GUIDE—An eight-page FLB cross-reference guide has been designed by Advance Transformer Co. for insertion in a catalog or for wall mounting. For copy, *circle No. 39.*

POWER FUSES—Bulletin FC4 from Line Material describes the type HXO power fuse rated 200 amp with asymmetrical interrupting rating ranging from 20,000 to 4,000 amp, 8.25 to 48.3 kv. *Circle No. 41.*

DISTRIBUTION REGULATORS—Overhead-type, single-phase, 32-step distribution voltage regulators, rated 2.5 through 13.8 kv and 25 through 668 amp, are described in bulletin RV2 available from Line Material. *Circle No. 42.*

THEATER LIGHTING—Two technical bulletins are offered by Hub Electric Co. Catalog 102 includes recommendations, illustrations and schedules for basic equipment suitable for school and community use. Bulletin 104 tells about several systems appropriate in size and cost for smaller stages. It also gives production notes, explaining various projection and design techniques. *Circle No. 43.*

STREET LIGHTING—Design and application of Holophane prismatic street lighting refractors is covered in a 24-page booklet. Section 1 illustrates basic prismatic principles, vertical and lateral distributions, open bottom-type one-piece refractor, and refractors for fluorescent lamps. Section 2 lists refractor illustrations, each with its specific basic-type light distribution for filament, vertical and horizontal mercury and fluorescent lamps. *Circle No. 44.*

CIRCUIT BREAKER—Application data on type H air circuit breakers and type F fused circuit breakers are included in a new catalog offered by Mears Controls. *Circle No. 45.*

CABLE TERMINALS—Information on its new PSC cable terminating equipment is offered by Joslyn in bulletin 146. For a copy *circle No. 46.*

COVER PLATES—A catalog of its complete line of doors and cover plates is offered by L. E. Mason Co. *Circle No. 47.*

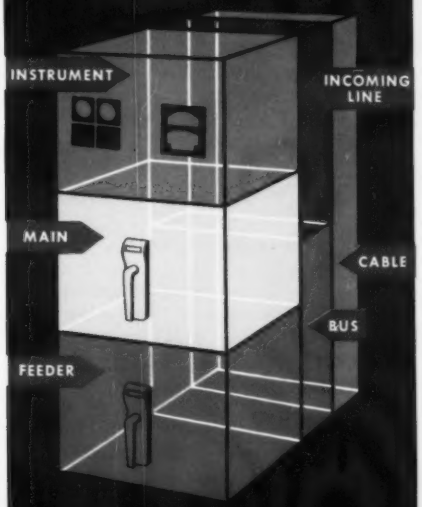
GROUNDING SWITCH—Specifications and catalog information on Line Material's type PGH high-speed grounding switch are available in bulletin No. PPSE-110. The two compact units offered come in ratings of 23 through 34.5 kv at standard BIL and 46 through 115 kv at 450-kv BIL. For a copy of this bulletin *circle No. 48.*

TRANSFORMERS—Engineering data on Sorgel's Quiet Quality dry-type transformers, ¼ to 10,000 kva, are available in technical bulletin No. 611. *Circle No. 49.*

SWITCHGEAR
AS NEW INSIDE
AS IT IS OUT

INTRODUCING . . .

New Powermaster Type AKD-5 Low Voltage Switchgear



Phantom view illustrates significant advances in compartmentation achieved in Powermaster Switchgear.

Highlighted by a new concept in appearance design, General Electric's new Powermaster Type AKD-5 Switchgear reflects the needs of today's modern power systems for increased safety, added convenience and . . .

GREATER RELIABILITY

For the highest degree of service continuity, compartmentation and isolation of the key functional components in the equipment:

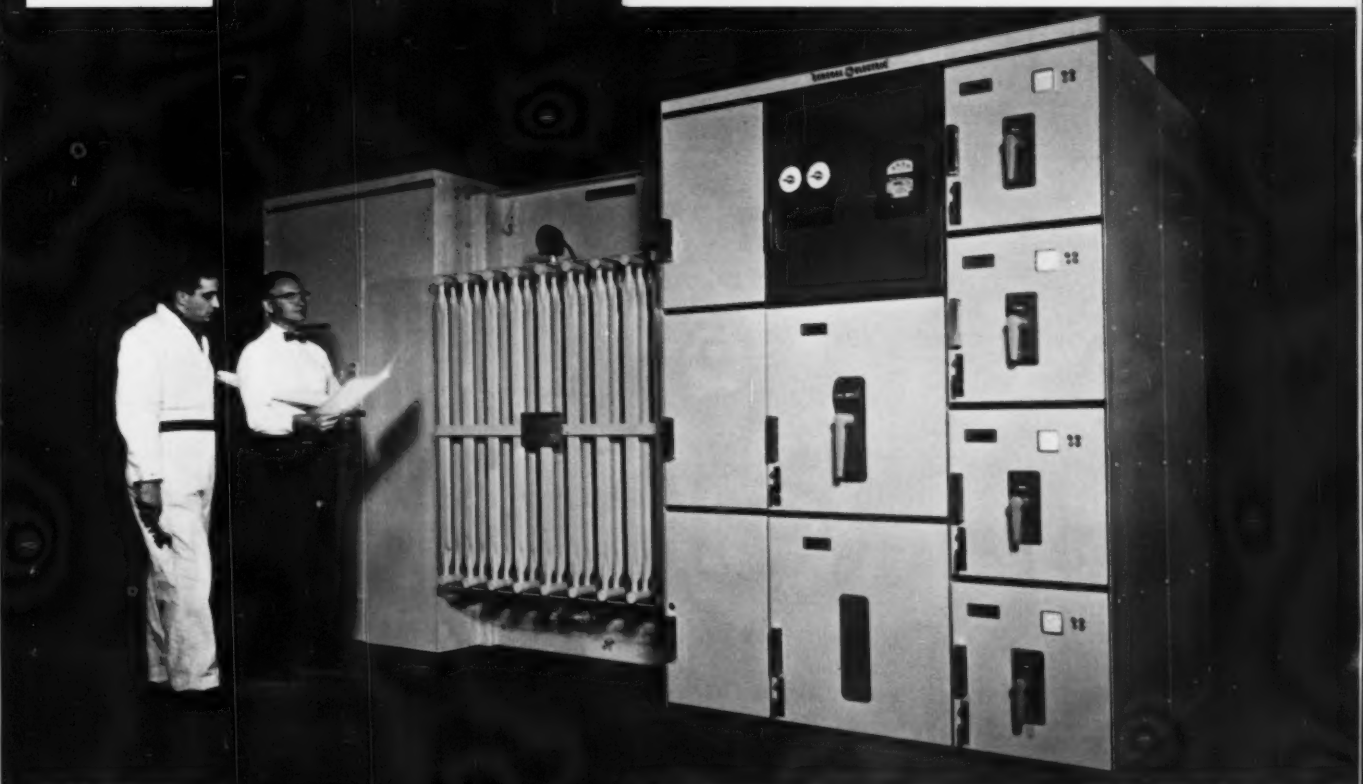
Minimize fault hazard—separate bus compartment prevents the entry of foreign objects such as tools, rodents, fish tapes, etc.—the major cause of bus faults.

Minimize fault communication—isolated incoming line compartment reduces hazard of fault transfer from the main bus to incoming line—thus permitting more effective operation of the main breaker on any possible bus fault.

Reduce maintenance requirements—Welded bus provides positive joints with a high degree of electrical conductivity—minimizes periodic tightening of bus bolts. New bus configuration and enclosure reduces dust contamination—minimizes cleaning requirements.

Call your General Electric sales engineer or send for publication GED-4269. *General Electric Co., Schenectady, N. Y.*

531-04



1000 KVA Load Center Unit Substation with Powermaster Type AKD-5 Switchgear. Colorful blue panels accent over-all appearance design.

GENERAL ELECTRIC

PRODUCT NEWS

New designs and applications

Postlights

Thomas Industries Inc.

Automatically operating postlights are being used in Seattle to supplement municipal street lighting. The postlights are installed in the front yard of each house in some areas like Seattle's Meridian Park subdivision, pictured above. These lights, manufactured by Moe Light Division of Thomas Industries, feature a photoelectric cell in the post that turns the lantern on at sunset and off at sunrise. The electric-eye unit also may be used to control other outdoor lanterns up to 200 w, in addition to the 150- to 200-w postlight. For electric yard tools, the post has an electric outlet.

Circle No. 51

Photoelectric Control

Fisher-Pierce Division

A new Fisher-Pierce control series said to offer completely automatic control of sign lighting or general illumination, plus a provision for manual switching, with no resetting necessary, has been announced. The control turns lights on when natural light fades to a certain intensity level, and turns them off when natural light reappears at dawn. In addition, lights may be turned off manually at any time by pressing a button on the control box. The lights will remain off until the next evening, when the control will automatically "remember" to turn the lights on.

Circle No. 52

Surface-Mounted Transformer

Allis-Chalmers Mfg. Co.

Introduction of a new line of low profile, single-phase, surface-mounted residential transformers has been announced by Allis-Chalmers. The new lightweight transformer is engineered for complete safety and installation, operation and maintenance ease. It is available in sizes 25 through 50 kva, 15 kv and below with a 240/120 secondary rating. Its high voltage interrupter switch is capable of interrupting full load current. The manufacturer says that these units are one-third smaller and lighter than existing units.

Circle No. 53

Grounding Connector

Anderson Electric Corp.

A new grounding connector has been introduced by Anderson Electric, called the Hamron. The grounding connector was designed to give the advantage of a compression connector without the disadvantages of a compression tool. The company says it is economical and easy to install by simply hammering it on.

Circle No. 54

Load-Interrupter Switch

S&C Electric Co.

A new high voltage load interrupter switch for metal-clad switchgear in industrial and commercial buildings is being marketed by S&C Electric. The new three-pole load interrupter switches up to 1,200 amp, closes on 60,000 amp when fused, and costs as much as $200 less than former models that could carry 1,200 amp but interrupt only 600 amp.

Circle No. 55

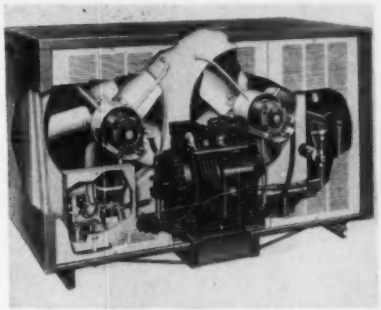
Quiet Transformers

Pennsylvania Transformer Division, McGraw-Edison Co.

A new method of reducing sound produced by transformers—by "uncoupling" of vibration-energy conducting paths within the transformer—has been developed and applied, according to Pennsylvania Transformer.

Vibration energy, generated by magnetic action in the core of a transformer, reaches tank surfaces through the liquid insulator and through the core supports—both efficient conducting paths for vibration energy. By destroying the effectiveness of these conducting paths, some of the vibration energy can be contained within the transformer.

Circle No. 56

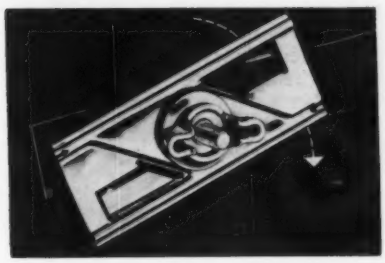


Air Conditioning Unit

Coleman Co. Inc.

A new 7½-hp remote air conditioning unit has been added to this company's line. The manufacturer says the major design features are compactness, rugged construction, full protection against rust and corrosion, good field serviceability and full sound conditioning for quiet operation.

Circle No. 57



Fixture Hanger

Tomic Sales & Engineering

A new T-bar hanger designed to simplify mounting of electrical fixtures to acoustical ceilings has been announced by this company. The hanger is said to have a holding capacity equal to that of the T-bar to which it is attached and is capable of being installed without tools simply by twisting it into position on the supporting member.

Circle No. 58

Colored Aluminum Paints

Subox Inc.

Colored aluminum paints are now available with a rust-inhibitive base. These new paints, called Subalox Anodine finishes, contain flaked pigments supplied by the Aluminum Co. of America in a base of chemically active suboxide of lead. They are said to be the only colored aluminum paints made in the United States with a rust-inhibitive base. These new paints are fully compatible with other existing paints and primers, and will adhere firmly to weathered galvanizing.

Circle No. 59

READER SERVICE CARD

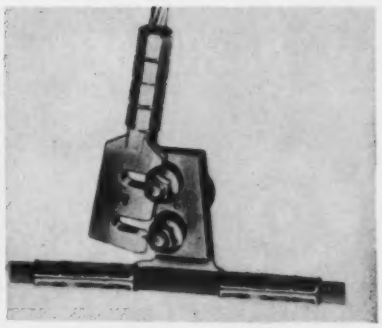
For your added convenience in obtaining more information on the new products shown on these pages or offered by our advertisers elsewhere in the issue, a postage-paid reader service card has been included between pages 78 and 79. Just circle the numbers corresponding to the items described and tear out and mail the card.

Cable Markers

Pyramid Instrument Corp.

A new way of marking circuits after identification has been announced by Pyramid. Designed to be used in conjunction with the new Amprobe Cable Tracer—an instrument that allows one man to trace and identify circuits 10 times faster than any previous method—the new wire markers, called Trace-Tabs, enable an electrician to mark both ends of up to 50 circuits quickly and easily.

Circle No. 61



Compression Disconnect

Penn-Union Electric Corp.

A new compression quick disconnect for hot line tool work, as well as for heavy duty manual disconnects, has been introduced by Penn-Union. The company says no loose parts can fall during installation as the U-bolt is rigidly attached and has peened ends retaining the nuts.

Circle No. 62

Chip Ejector

Price & Rutzebeck

An unusual boring bit and chip ejector combination, ideal for utility and telephone company use, has just been introduced across the nation. The manufacturer says the new device, incorporating a chip ejector, solves the problem of chip clogging in deep hole boring work on poles and other timber structures.

Circle No. 63

Square Panel Fluorescent Lamp

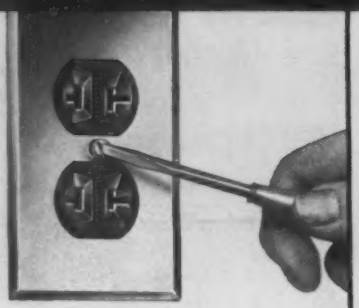
General Electric Co.

General Electric Co. has announced a new fluorescent lamp in the shape of a thin, square panel, measuring 11⅝ in. square and 1½ in. deep. The lamp is designed to operate at 80 w, at which rating it produces 4,800 lumens, giving it an efficiency of 60 lumens per wat

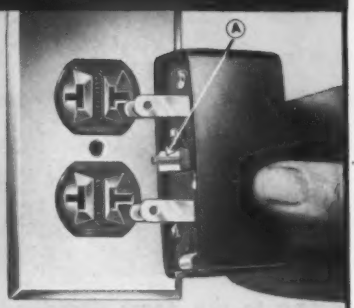
Circle No. 64

HUBBELL DUPLEX ADAPTER

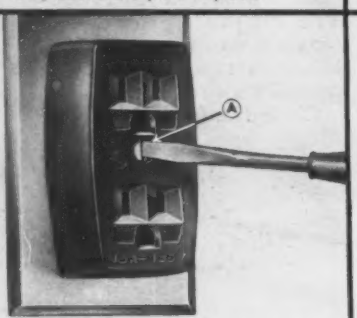
15 A., 125 V.



Hubbell Duplex Adapter No. 5291 is easy to attach. Just remove screw holding metal or plastic plate to 2-wire receptacle. Leave plate in place.



Adapter plugs into 2-wire receptacle. Screw A will go through plate to grounded box. It is connected to both U-slots of adapter.



Tightening Screw A establishes adapter ground in a grounded system. If the system is ungrounded, connect adapter as shown at right.

When an existing system is not properly grounded, the adapter may be grounded by connecting a grounded wire to green hex Screw B.

FAST TEMPORARY CONVERSION TO 3-WIRE GROUNDING SAFETY

This polarized, plug-in adapter converts 2-wire duplex receptacles used with grounded or ungrounded systems to temporary 3-wire grounding receptacles. Landlords find it a great convenience when tenants requiring 3-wire facilities cannot postpone occupancy until rewiring is completed.

To make a conversion, nothing in the existing system has to be removed except receptacle cover-plate screws, to make room for a captive screw in each adapter. This captive screw acts as a conductor from the two U-slots to the grounded system. For use with receptacles in ungrounded systems, there is a green binding screw to permit connection of an independent ground wire. Either way, the electrically independent blades and contacts continue existing split circuits.

The polarized adapter operates in any parallel or T-slot duplex receptacle with metal or plastic cover plates. Brown or ivorine bakelite, for 15 amperes, 125 volts. Size: 1.4" from plate, 3.3" high, 1.75" wide.

HARVEY HUBBELL INCORPORATED

Bridgeport 2, Connecticut

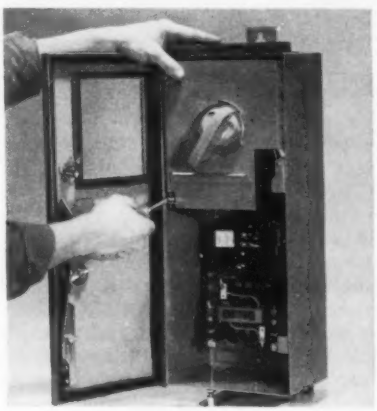
In Canada: Scarborough, Ontario

Distribution Transformers

Allis-Chalmers Mfg. Co.

Introduction of a new lower and lighter oil-immersed line of distribution transformers has been announced by Allis-Chalmers. The new transformers are said to provide greater overload capabilities through larger cooling duct area, higher-temperature insulation and higher temperature oil, while the lower impedance permits utilities to take full advantage of the overload capabilities of this design.

Circle No. 65

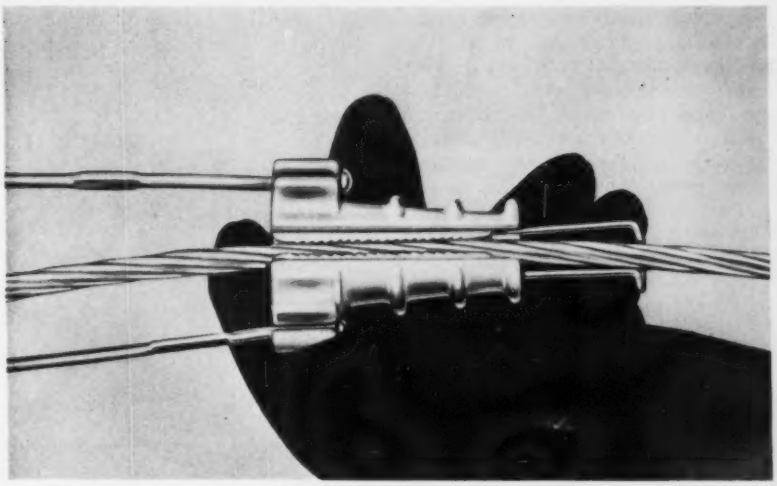


Combination Starter

General Electric Co.

This new starter is said to utilize a unique double-door, dead-front construction designed to discourage unauthorized entry which could bring about injuries to personnel and damage to plant equipment. This combination starter also meets the latest Joint Industry Conference and automotive requirements.

Circle No. 66



Dead-End

Burndy Corp.

A new wedge-type dead-end, which can be attached at the house or pole in two simple steps, without threading the cable or disassembling the connector, has been developed by the Burndy Corp. The company says dead-ending services go faster and easier with the new side-entrance clamp for cable sizes No. 6-No. 2 AAC and No. 6-No. 2 ACSR.

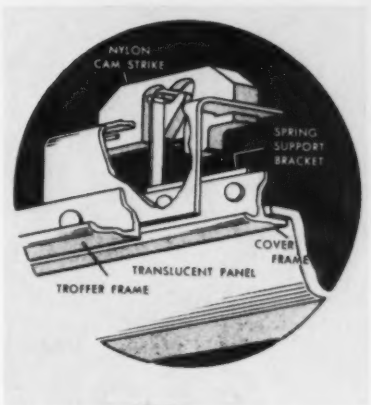
Circle No. 67

Lightning Arresters

Line Material Industries

New lines of distribution class, valve type, lightning arresters, said to afford significant improvement in apparatus protection, are available from Line Material Industries. These arresters, designated type E5 direct connected and T5 externally gapped, are manufactured in standard voltage ratings of one through 20 kv.

Circle No. 68



Lighting Fixture Latch

Stanley Hardware

A completely concealed push-release latch, streamlined and functionally designed, has been introduced by this company for use with recessed or surface mounted lighting fixtures.

The design is said to allow fixtures to present clean, unbroken lines, while easily adapting them to rapid maintenance position.

Circle No. 69

Residential Humidifier

Westinghouse Electric Corp.

A new residential humidifier for wintertime humidity control in forced-air installations is available from Westinghouse Air Conditioning Division. The humidifier has a 0.2 gal-per-hour atomizing capacity and is designed for simple installation in the return duct of any heating or cooling system.

Circle No. 71

KLEIN
-KORD
NYLON
SAFETY
STRAPS

WITH THESE FEATURES

Klein developed the first fabric safety strap and have pioneered in every development. The recently introduced Klein-Kord Nylon Safety Strap offers these features:

LONGER LIFE—Superior construction, woven from filament nylon. Stretch has been almost eliminated.

PLY ADHESION—The multiple plies of strongly woven pre-dipped nylon are frictionized in neoprene and vulcanized.

FLEXIBILITY—Klein-Kord Nylon Safety Straps are extremely flexible and assure maximum comfort and greater strength. When tested in use, these straps are capable of a test load of 2750 pounds, far in excess of any load they will be called upon to support in service.

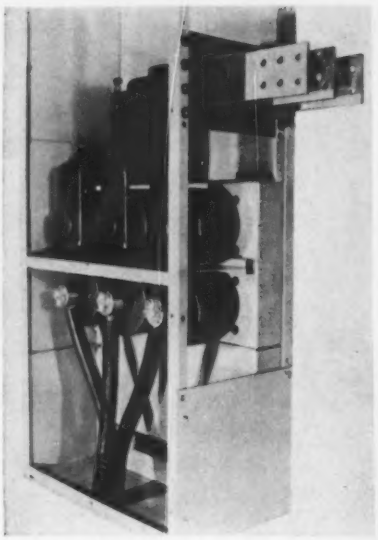
QUALITY HARDWARE—All buckles and snaps are drop-forged and tested by Klein in their own forge shop.

WRITE FOR BULLETIN 560

ASK YOUR SUPPLIER

Foreign Distributor:
International Standard Electric Corp., New York

Mathias Established 1857 KLEIN & Sons Chicago, Ill., U.S.A.
INCORPORATED
7200 McCORMICK ROAD, CHICAGO 45, ILL.



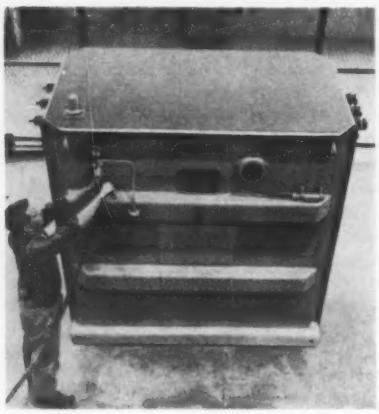
Metal-Clad Switchgear

Moloney Electric Co.

Moloney has introduced a line of metal-clad switchgear. The new switchgear manufacturing division, which is located in newly acquired facilities near the St. Louis transformer plants, will produce metal-clad gear for both indoor and outdoor applications in all standard five- and 15-kv breaker ratings.

The switchgear is said to be in keeping with the trend toward smaller, more compact units.

Circle No. 72



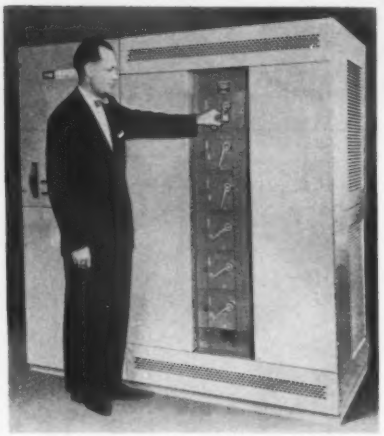
Gas-Filled Transformer

General Electric Co.

A newly designed gas-filled, sealed dry-type transformer in ratings 300 kva and above, 15 kv and below, has been announced by General Electric's medium transformer department. The industrially rated unit utilizes perfluoropropane as an insulating/cooling medium, and offers higher impulse levels, lighter weight and smaller dimensions than the former nitrogen-filled unit.

The gas-filled units are designed for application as conventional transformers or as the transforming section in unit substation combinations. Price of the gas-filled, sealed dry-type units will be comparable to the former nitrogen-filled units, according to the manufacturer.

Circle No. 73



Package Power Center

Federal Pacific Electric Co.

Package Power Centers featuring rotary handle circuit breakers in the secondary distribution section have been introduced by Federal Pacific. Rated up to 500 kva, the new line of indoor unit substations is available for primary voltages of five or 15 kv. The company says the chief advantages of the new units are their compact size, operator safety and front access of all operating parts.

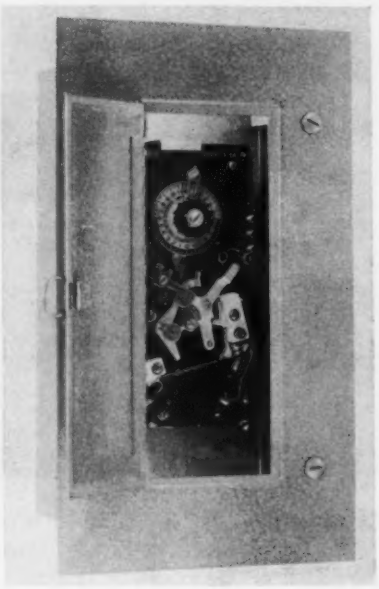
Circle No. 74

High-Speed Grounding Switch

I-T-E Circuit Breaker Co.

I-T-E has announced an automatic high speed grounding switch to trip remote breakers adjacent to transformers. Known as type HSG, the manufacturer says the new grounding switch features a closing speed ranging from 3.3 cycles at 15 kv, up to 19 cycles at 230 kv. It is available in voltage ratings from 15,000 through 230,000 v with momentary ratings of 20,000 and 40,000 amp.

Circle No. 75

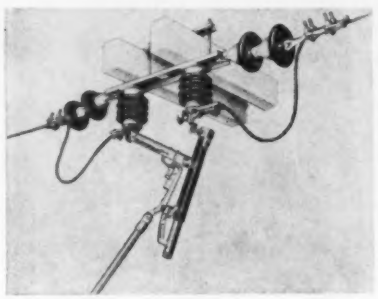


Time Switches

Sangamo Electric Co.

Precision time switches built in flush-mounted steel cases are being announced by Sangamo Electric. The company says they will be ideally suited for switchboard, wall or panel mounting. Both straight synchronous and synchronous-carryover models will be available.

Circle No. 76



Loadbuster Uprated

S&C Electric Co.

Continuous current ratings of Loadbuster disconnect switches have been raised from 400 amp to 600 amp by S&C Electric Co. All Loadbuster disconnect switches now in service use S&C silver-weld contact construction which provides the 600-amp continuous-current rating. The prior 400-amp rating indicated the disconnect's load switching capability using Loadbuster, S&C's portable load-break tool, rather than its continuous-current rating.

Circle No. 77

CIRTUBE EMT is the one on top

Shown here unplated

The other one is ordinary EMT that failed early in a pressure test. CIRTUBE EMT held up far beyond UL requirements. The reason: *continuous induction welding*, by far the best technique for making *bead-free, split-free* welds on high quality EMT.

The benefit: your men get easier, neater bending without kinking or flattening—and they get it right the first time around. Add easy fishing, a good-looking, life-time finish, easy-handling bundles and fast, friendly service—and you'll know why more and more contractors are specifying CIRTUBE EMT.

Ask for it on your next job—you'll like working with it.

CIRCLE WIRE & CABLE CORP.

SUBSIDIARY OF **CERRO CORPORATION**

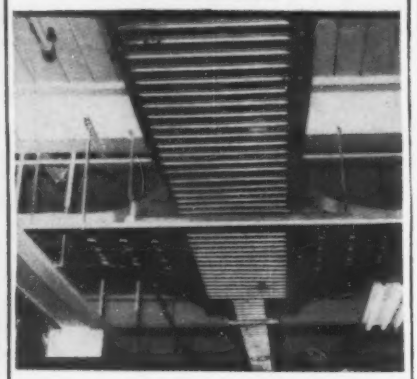
PLANTS: Maspeth and Hicksville, N. Y. **SALES OFFICES & WAREHOUSES:** In all principal cities.
Rubber Covered Wires & Cables • Varnished Cambric Cables • Plastic Insulated Cables • Neoprene Sheathed Cables • "CIRTUBE" EMT

CIRTUBE EMT *Ask for it!*

Save Time, Money Speed Installations with . . .

P-W

CABLE SUPPORTING SYSTEMS



P-W's TYPE "E" (PUNCHED BOTTOM) TRAYS—FOR POWER AND CONTROL CABLES AND INSTRUMENT TUBING—ALTHO LESS EXPENSIVE, ARE STRONGER, VERSATILE AND SUPERIOR. CONTROL CABLE CAN BE DROPPED OUT ANYWHERE.

Engineers, Contractors and Installers look for QUALITY, LONG LIFE, AND LABOR SAVINGS in their supports. That's why more and more users are turning to P-W. Among our outstanding improvements are: CONNECTIONS that are quick and easy to install—PRE-CUT SYSTEMS saving installation time—EXTENSION CONNECTORS eliminating field cutting to complete runs — ADJUSTABLE HORIZONTAL and RISER CONNECTORS to go over, under or around pipes, trusses, columns, etc. — BUILT-IN ADJUSTABLE DROP-OUT SECTIONS eliminate cutting out bottom of tray — STRAIGHT SECTIONS available in lengths up to 16' (33⅓% less connectors and less installation time over 12' lengths).

P-W SUPPORTS are available in hot dip galvanized steel or aluminum, in LADDER, EXPANDED METAL and SOLID TRAYS in addition to Type "E". All systems are interchangeable. Write for Catalog 858-A.

For the utmost in service, contact the appropriate Representative in your territory or P-W direct, regarding inquiries and placing orders.

P-W INDUSTRIES
11200 Roosevelt Blvd.
Philadelphia 15, Pa.

Gas Turbine-Generator

General Electric Co.

A new emergency power plant—the first installation of its kind in the nation—has been installed on the roof of Pacific Telephone's 1587 Franklin St. building, Oakland, Calif. The compact power package, consisting of gas turbine, gearbox and generator is light enough to be carried by three men and yet is capable of supplying communications power for a city of 70,000.

The 320-lb turbine was produced by General Electric. It burns a regular diesel fuel. The whole unit—turbine, gearbox and generator—is not much longer than a compact car.

The G-E set weighs only 12,235 lb compared to 43,100 lb for its diesel generator counterpart, a 70% saving in unit weight.

Telephone and G-E engineers pointed out that the complete package will lessen maintenance problems normally encountered with this type of installation.

Circle No. 78

Long Scale Instruments

Federal Pacific Electric Co.

A new line of long scale instruments, consisting of both a-c and d-c devices, has been introduced by Federal Pacific Electric Co.

Designed for use in control and distribution switchboards where quick and accurate readings need to be made at considerable distances, the new instruments have as the key to their operation a pointer that moves over a 250° arc scale more than 7 in. in length.

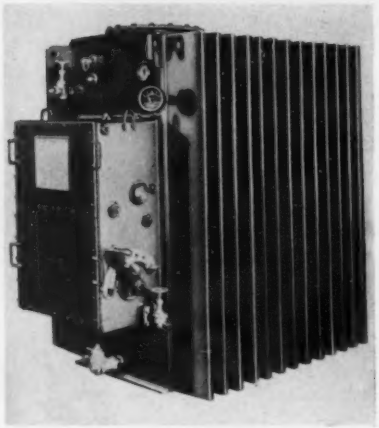
Circle No. 79

345-Kv Switches

I-T-E Circuit Breaker Co.

The Greensburg Division of this company has just completed shipment of what is believed to be the first two 345-kv double-break switches to be installed in this country. The new switches are rated 1,300 kv BIL, 1,600 amp continuous and 70,000 amp momentary. They are equipped with grounding blades on both ends, for grounding either the 345-kv line or the high side of the step-down transformer, or both. The grounding switches are key interlocked so that they cannot be closed unless the main switch is open.

Circle No. 81



Network Transformers

Wagner Electric Corp.

Compact network transformers, designed to fit into close quarters, are offered in 300- through 2,500-kva ratings by Wagner Electric Corp., St. Louis, Mo. Space-saving features of these transformers permit up-rating existing secondary network systems by installing higher transformer ratings in present vaults, and also permits lower construction costs on new systems.

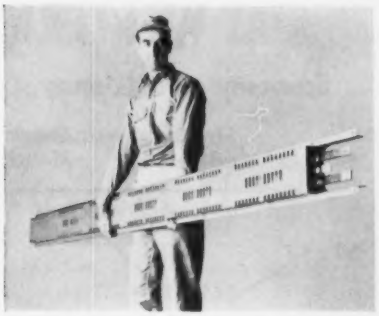
Circle No. 82

Network Meter

Duncan Electric Co.

The Duncan Electric Co. has announced a new polyphase watt hour meter that is said to be a simplified two-stator device, used for metering three-wire network services consisting of two lines and a neutral of a four-wire wye system. The company stated that initial calibration of the meter is made by adjusting the strength of the two pairs of side-mounted damping magnets, while the fine adjustment is made with torque adjusting screws.

Circle No. 83

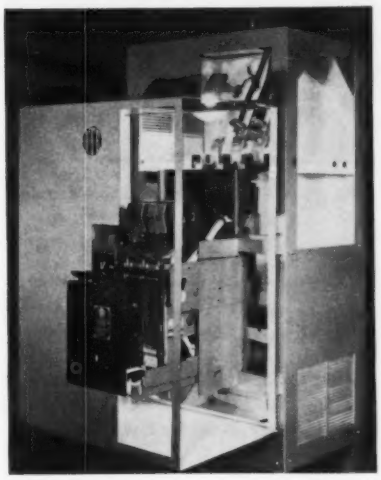


Busways

Electric Distribution Products Inc.

An improved line of bus feeders and plug-in busways, featuring a new type of construction, has been announced by this division of Worthington Corp. The new construction provides higher insulation efficiency, greater inherent safety, lower weight, and increased resistance to damage from electrical stresses or improper handling, according to the manufacturer.

Circle No. 84



Individual Breakers

I-T-E Circuit Breaker Co.

Individual enclosures for its new line of K-Don circuit breakers—low-voltage current-limiting units affording fault protection against currents as high as 200,000 amp—have been developed by I-T-E Circuit Breaker Co.

The K-Don breakers are now available in the new enclosures for many applications in industrial plants, commercial buildings and institutions where single, wall-mounted breakers are used.

Circle No. 85

NEW IDEAL

"YELLOW 77"

WIRE PULLING COMPOUND

Creamy textured, yellow color, not messy, "good" smell.

- works best where the pulling is toughest—all wire sizes—including 500 MCM and larger.
- spreads out on wires in long runs—it won't quit halfway through!
- a little goes a long way.
- safe for hands and insulation, not damaged by freezing, won't dry out in the can.

EASILY APPLIED by hand, brush or cloth. Wipes off hands easily. It doesn't "wash-off" when pulling through water in conduits. Can be used to pull wires through steel, fiber or aluminum conduit. Clings around sharp bends and corners. Available in quart and gallon cans, 5-gallon pails and 55-gallon drums.

SOLD THROUGH AMERICA'S LEADING DISTRIBUTORS

IDEAL **For complete details, write**

IDEAL INDUSTRIES, Inc.
1042-G Park Avenue, Sycamore, Illinois
IN CANADA: Irving Smith, Ltd., Montreal

ARRANGE DOWNTIME
OF ELECTRICAL EQUIPMENT
TO FIT YOUR SCHEDULES

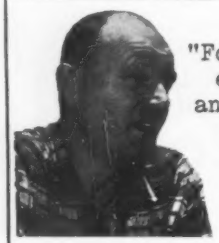
Don't let motors or controls go out of service due to moisture or dust, until it's convenient for you to service them. CRC 2-26 keeps electrical equipment operating—it loosens and stops rust and corrosion, cleans, lubricates.

Write for complete information to:
CORROSION REACTION CONSULTANTS
116-2F Chestnut Street
Phila. 6, Pa.

Ask your distributor

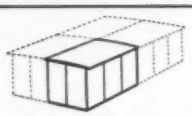
CRC 2·26

LOW COST PREVENTIVE MAINTENANCE



"For a combination electrical field office and storage shed that's quick to move on and off the job, I like Porta House. We have them on several jobs."

Just telephone Porta House collect and get immediate delivery. Prefabricated, bolted, waterproof plywood panels—can be moved on a pick-up truck.



SIZES 6' OR MORE BY 9' OR MORE.

PORTA HOUSE

Ridgely K. Dodge — 6767 Broadway Terrace, Oakland, Calif.

Phone collect for immediate delivery: OLympic 2-7237

Distributor (Sales & Rentals): Porta House, 8833 So. Alameda St., Los Angeles 2 • LUdlow 3-1301

ELECTRICAL CONTRACTORS:

You waste a lot of time and money bidding on many jobs you do not get. This costly waste cuts deeply into your profits and you do not make the money you should. We can furnish you excellent electrical estimating service at a saving of over 50% of your present estimating costs. We can furnish you take-offs and man hours only, or we can furnish complete estimates showing detail lists of materials, at current unit prices, and man-hours and labor costs, together with a detailed list of overhead items and profit. You can check each item of our estimate and compare it with your own. Thus you get the benefit of two independent estimators in the preparation of your bids, all at a definite saving in estimating cost.

Call us for complete information; without obligation, of course.

LeROY CONSTRUCTION SERVICES

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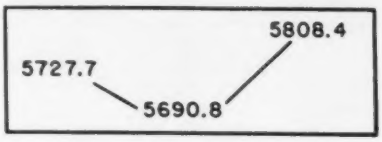
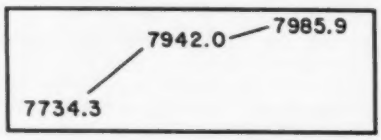
WESTERN

Economy at a Glance

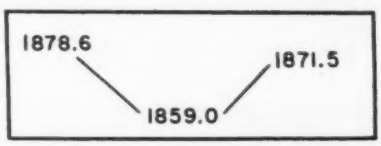
Year Ago	Month Ago	Latest Month



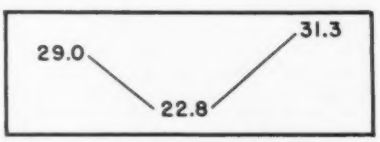
PERSONAL INCOME in millions—seasonally adjusted as of June 15 (An index of consumer spending potential)



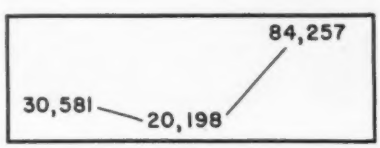
NONFARM EMPLOYMENT in thousands (Index of industrial, commercial activity)



MANUFACTURING EMPLOYMENT in thousands (A measure of manufacturing activity)



HOUSING STARTS in thousands of units (Index of new residential customers)



INDUSTRIAL BUILDING CONTRACTS in thousands of dollars (A rough index to the dollars of electrical contracting business six months to a year ahead)

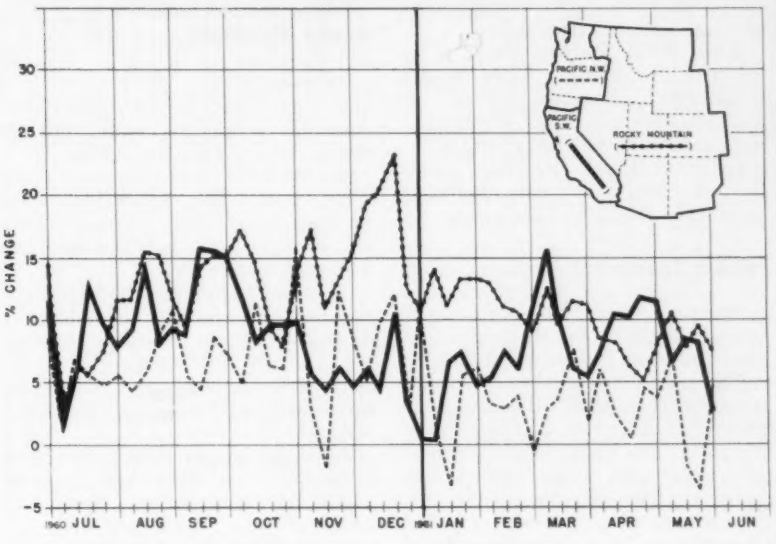
► The West and particularly the West Coast led the nation in percentage of gain in the use of manufactured homes, according to a report just released by the Home Manufacturers Assn. Arizona, California, Washington and Oregon each increased their starts of factory-built homes by more than 50%.

Source: McGraw-Hill Department of Economics.

BUSINESS TRENDS & INDICATORS

Output Comparisons

Year-to-Year Kwh Output Changes. Per Cent Change Over Same Week One Year Ago for Region as Indicated in Keyed Map



Cyclical Earnings Recovery in Prospect

A strong cyclical earnings recovery is in immediate prospect for the electrical equipment industry, the Value Line Investment Survey states. The next 12 months may see profits advance about 35%. Inventories are generally in good shape. Costs, pruned during the past few quarters, are under tight control. Here and there, price increases have been tentatively initiated.

Meanwhile, as the furor over the price-fixing convictions dies down, the Value Line Survey sees these probabilities emerging: (1) the loss of prestige for the companies involved will prove temporary and leave no permanent scar on their corporation images; (2) the sums to be paid out in damage settlements will be far below the huge amounts originally bruited about. Ironically, manufacturers found guilty of fixing prices with competitors are now being asked by the government to promise they will not reduce prices unreasonably.

RELATIVE WHOLESALE PRICES OF ELECTRICAL MATERIAL

	Latest Month	Previous Month	Year Ago
Wire and cable	128.9	128.9	138.0
Watt-hour meters	118.6	118.6	120.9
10-hp motors	136.9	136.1	154.9
225-hp motors	176.8	182.3	223.9
Hydro generators	185.5	185.5	192.1
Steam generators	203.5	203.5	203.5
15-kva transformers	133.0	133.0	133.5
50-kva transformers	131.0	131.0	141.2
500-kva transformers	128.8	137.9	151.5
Dry-type transformers	133.7	133.7	149.6
Switch and fuse panelboards	126.0	126.0	132.4
Circuit breaker panelboards	139.2	139.2	139.1
Indoor oil circuit breakers	182.5	182.5	182.5
Outdoor oil circuit breakers	155.3	155.3	182.8

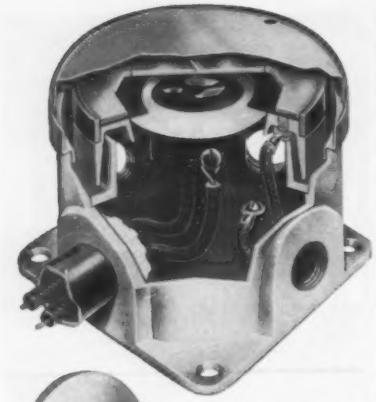
BELL
The BEST in WEATHERPROOF
MOST COMPLETE LINE of Weatherproof COVERS and BOXES

SAFE-T-LOK WEATHERPROOF SNAP COVERS & RECEPTACLES
Snap Open . . . Stay Open . . . Snap Shut! 1 to 10-Gang Combination Switch & Receptacle Device.
SOLID BRASS

New! Construction Features
NEW EXTRA-SAFETY TAMPER-PROOF SNAP-COVER
Equipped with Padlock Hasp — Stops Current Pilferage, Tampering, Accidental Shock. 1, 2, 3-Gang Duplex Receptacle, or combination switch and receptacle.

New! Easy Installation
BELL BOXES
moistureproof
Aluminum 1-Gang and 2-Gang 3 to 7 hubs, ½" or ¾" with aluminum plugs.
New! UNIVERSAL BOX
fits practically any cover — holds device firmly.

New! Quality Performance
NEW PORTABLE WEATHERPROOF LAMPHOLDER OUTLET BOX
Lampholder, outlet and switch in aluminum housing. Complete with spike and cord. Spikes in ground for electricity and lighting where needed.
Write For Complete Weatherproof Catalog
BELL ELECTRIC CO.
5735 S. Claremont Ave.
Chicago 36, Ill.



2 TIN LIDS for OVER-ALL HEIGHT CONCRETE POUR

This Cast Iron adjustable floor box comes with a 2 part Tin Lid for top concrete pouring. The cut-away picture above shows top adjusting section with brass cover-plate and two tin lids exposed.
The top tin lid is removed after hardening of concrete along with top adjusting section, providing easy access to wiring.

FULLMAN MANUFACTURING CO.
LATROBE . . . PENNSYLVANIA

SALES AGENTS WANTED

Sylvania Lighting Products-Fixtures is seeking established sales agencies to represent them in Northern and Southern California. Only applicants with proven sales record and a strong background in lighting fixture specification will be considered. Contact Dept. MPD, Sylvania Electric Products, 48th Street, Wheeling, West Va.

WANTED

Sales minded supervisor of power circuit breaker marketing needed by nationally known electrical equipment manufacturer at San Francisco-Peninsula Plant. EE Graduate preferred, some experience desirable. Position involves inside work plus nationwide travel and customer contact. All replies held confidential. Send resume with salary requirements to Box 320, Electrical West, 255 California St., San Francisco 11, Calif.

WANTED—SALESMAN

Manufacturer of complete line of electrical wiring devices, fuses, etc., with Los Angeles warehouse stock, has opening for aggressive, alert salesman in Los Angeles territory calling on electrical and hardware wholesalers, contractors, architects and OEM accounts. Send complete resume to Box 319, Electrical West, 255 California St., San Francisco 11, Calif.

Proposed Western Projects

Hawaii

Aiea, Pearl Harbor Heights Developers, Halawa Heights homes, $4,208,390. George Barrett, architect, and Fred Pack Associates, engineers, both of Honolulu.

Aiea, Pearl Harbor Heights Developers, Enchanted Hills homes, $3,469,000. Hawaiian Pacific Industries, architects, and W. K. Collins, engineer, both of Honolulu.

Lahaina, Donn Beach, Pioneer Inn addition, $1,200,000. Plans by Wimberly & Cook, Honolulu.

Pacific Southwest

Phoenix, Ariz., Maricopa County, hospital, $10,572,000; court, jail and administration bldgs., $11,042,000.

Phoenix, City, parks and playgrounds, $6,100,000; libraries, $2,200,000; civic center, $1,150,000; police and courts bldg., $3,000,000; airport expansion, $14,200,000; developing satellite airports, $1,000,000.

Anaheim, Calif., Butler Harbor Construction Co., dwellings, $1,693,500.

Baldwin Park, Unified School Dist., schools, $3,000,000.

Fontana, Southern California Edison, steam-electric generating unit, $43,155.000.

La Puente, Sunset International Petroleum Co., dwellings, $1,583,000.

Los Angeles, University of California, Physics bldg., $4,500,000. Plans by Neptune & Thomas & Associates.

Monterey Park, Central Land Co., dwellings, $1,298,100.

Newport Beach, High School Dist., high school, $4,270,000. Plans by Blurock, Ellerbroek & Associates, Corona Del Mar.

Norwalk, Larkwood Estates, dwellings, $2,500,000.

Palm Desert, Coachella Valley Junior College Dist., Physical Education bldgs., $1,080,600. Plans by Williams & Williams, Palm Springs.

Pasadena, National Aeronautics & Space Administration, physical science lab, $1,285,000.

San Diego, County Board of Supervisors, operations center, $3,000,000. Plans by Tucker, Sadler & Bennett.

Santa Barbara, Cottage Hospital, central core bldg. and remodeling present bldgs., $2,000,000. Plans by Stone, Marraccini, & Patterson, San Francisco.

Santa Susana, Atomic Energy Commission, Argonne, Ill., test facilities. Plans by Ralph M. Parsons Co., Los Angeles.

Van Nuys, Kingswood, dwellings, $1,447,000. Charles E. Du Bois, architect, Encino.

Rocky Mountain

Denver, Colo., Mid-American Building Corp., 30-story office, $12 million. Plans by Sorey, Hill & Sorey, Oklahoma City, Okla.

Rocky Ford, Otero County School Dist., high school, $1,090,000. Paul S. Pierson, Denver, architect; Caudill-Rowlett & Scott, Houston, Tex., associate architects.

Moscow, Idaho, University of Idaho, Student Union bldg. addition, $1,350,000. Plans by Dropping, Kelley & Finch and Wayland & Cline, both of Boise; Marque & Associates, mechanical and electrical engineers, Spokane.

Billings, Mont., Yellowstone County School Dist., high schools, $1,100,000. Elementary schools, $2,335,000, Joseph Gates, architect.

Great Falls, U. S. Engineers, Seattle, strategic missile support area facilities, $2,000,000.

Logan, Utah, City Board of Education, school and school addition, $1,422,000.

Ogden, Hill Air Force Base, U. S. Engineers, San Francisco, missile maintenance facility, $2,600,000.

Green River, Wyo., School Dist. No. 2, junior high school, $825,000.

Pacific Northwest

Vancouver, B. C., E. J. Vernon, hotel, $1,000,000. Plans by D. H. Miller.

Vancouver, Pacific National Exhibition, livestock show bldg., $2,200,000. Plans by W. K. Noppe.

Berkeley, Calif., Strawberry Creek Lodge Foundation, apartment, $1,383,760. In care of Norris M. Gaddis, architect, Oakland.

Castroville, Jennings Radio Mfg. Corp., power switch plant, $1,500,000.

Concord, Hill & Rhodes, shopping center, $3,500,000.

Fresno, Spreckels Sugar Co., processing plant, $16 million.

Moffett Field, National Aeronautics & Space Administration, hypervelocity free flight facility, $4,880,000.

Monterey, 12th Naval Dist., San Bruno, Calif., astro aeronautical propulsion labs, $3,000,000.

Novato, Fifth Associates Real Es-

TESTS PROVE:
10% more slip
with
Y-ER EAS
Wire Pulling Lubricant
For Lead, Rubber, Braid or Synthetic Covered Cables

There is only one Y-ER EAS

Don't accept substitutes. The extra slip means extra savings on every job.

- Creamy, non-corrosive. Never greasy or messy.
- Prevents sticking or setting. Extra slip for saddles and turns.
- Does not run back on cables.
- Never harmful to hands, clothing, cables or conduit.

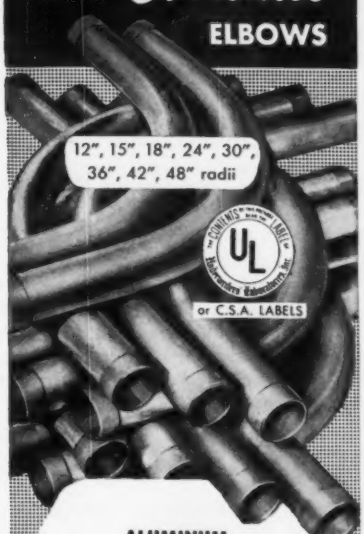
NEW! ALUM-N-EAS
Thread lubricant stops binding of aluminum conduit connections!

Write for descriptive literature

At all Leading Electrical Supply Houses

ELECTRO COMPOUND CO.
4148 W. 150th St., Cleveland 35, Ohio

Special Large Radius
RIGID Conduit
ELBOWS



ALUMINUM
Hot Dip Galvanized

CONDUIT NIPPLE MFG. CO.
1455 SPRING GARDEN AVE. PITTSBURGH 12, PA.

tate Trust & Luigi Demartini Trust, shopping center, $1,500,000. Plans by Wurster, Bernardi & Emmons, San Francisco.

Oakland, 1200 Lakeshore Inc., 16-story apartment, with three-story building, including boat dock, $7,500,000. Plans by Simpson, Stratta & Associates, San Francisco.

Oakland, Gilmore Steel Corp., distribution plant expansion, $1,500,000.

San Francisco, Eichler Homes Inc., Diamond Heights housing development, $3,500,000. Plans by Claude Oakland.

San Francisco, Eichler Homes Inc., Western Addition apartments, $1,200,000. In care of Claude Oakland, architect.

San Francisco, City and County, Palace of Fine Arts, to include 1,500-seat theater, 500-seat theater, exhibit hall, offices, radio-tv sound stages, $5,800,000. Plans by William Gladstone Merchant and Welton Beckett & Associates; Ellison Sedgwick & Associates, consulting engineers.

San Jose, Santa Clara County Board of Supervisors, courthouse, $1,545,000. Plans by Ernest Kump, Palo Alto; Wheeler & Gray, Perry E. West Associates, consulting engineers, Palo Alto.

Sausalito, Kurt Heath & Allied Grocers, shopping center and office, $2,500,000. Plans by Campbell & Wong, San Francisco; Kenneth Frost Associates, Tiburon, consulting engineers.

Santa Rosa, City High School Dist., school additions, $2,500,000. J. Clarence Felciano, architect.

Sonoma County, Pacific Gas and Electric Co., 12,500-kw generating unit, The Geysers geothermal power plant addition, $2,200,000.

Stockton, Lincoln Unified School Dist., high school, $1,828,910. Plans by Barovetto & Thomas; Walter Buehler, consulting engineer.

Walnut Creek, Russell J. Bruzone, shopping center, $1,500,000.

Yuba City, Yuba Plaza Inc., shopping center, $2,600,000. In care of Julian C. Wilke, architect, Redding.

Lake Tahoe, Nev., Berkeley Plywood, apartments, $5,000,000. Plans by Sherrill Broudy, Alameda, Calif.

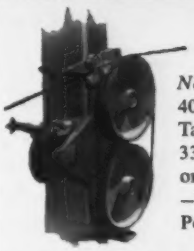
Lake Tahoe, Kaufman & Broad Development Corp., Detroit, homes, $6,000,000.

Pullman, University of Washington, Education bldg., $1,500,000. Plans by R. H. Burkhard, Seattle.

Seattle, University of Washington, health sciences bldg. addition, $1,000,000.

Vancouver, School Dist. No. 37, junior-senior high school, $1,500,000. Plans by McCoy & Bradbury.

NEW
PENGO
POLE-MOUNT
TENSIONER



Now...PENGO 4000 Tensioner Takes Conductor to 336,500 cm-ACSR or 397,500 cm-AAC —Tensions to 1,000 Pounds!

Here's a bullwheel tensioner you can carry in every line truck! It features two 18 inch neoprene lined bullwheels. Tru-Stop disc brake — yet weighs so little it's truly portable.

Two men can easily place the 4000 PM against the pole, attach it (chains and wing-nut tightener are permanently attached to tensioner), and start stringing in a matter of minutes. Conductor can be payed off any suitable reel stand. A collapsible reel attached to a winch shaft makes a practical puller, although any type of power previously used for pulling can be used.

TENSION WIRE STRINGING is the safe, economical modern way to string distribution and transmission lines. Why not get the facts? Write for new PENGO catalog TSE-1 for full data on the world's largest, most complete line of tension stringing equipment. Please address Dept. 34.

PETERSEN ENGINEERING CO., INC.
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B-15

Estimator's Guide

Prices shown are for new construction cost in place. Quotations furnished by LeRoy Construction Service

The figures in this guide, furnished by LeRoy Construction Service, will be kept up to date and published periodically. This guide is for your use. Will you please let the editor know if there are other figures or ideas which would make this section more valuable to you?

Residential Wiring

PER OUTLET, 120 V—2 WIRE		
Knob & tube	Each	7.50
Nonmetallic cable	Each	7.00
Armored cable (BXL)	Each	16.00
Armored Cable (BX)	Each	7.50
Flexible metallic conduit	Each	14.00
EMT	Each	18.00
Conduit rigid	Each	23.00
PER OUTLET, 230 v—3 Wire (RANGE—OVEN—WALL HEATER)		
Nonmetallic cable (Romex)	Each	14.00
Flex conduit (Greenfield)	Each	22.00
EMT	Each	23.00
SERVICE & PANEL		
Light panel & service		
50 amp lugs 120/240 v—3 wire		
4 1 pole circuit, 15 amp fused		70.00
Light panel & service		
100 amp ACB 120/240 v—3 wire		
4 1 pole circuit, 15 amp		
2 2 pole circuit, 20 to 50 amp		150.00
Light panel & service		
100 amp—ACB 120/240 v		
6 1 pole circuit, 15 amp		
3 2 pole circuit, 20 to 50 amp		165.00
Light panel & service		
100 amp—ACB 120/208 v, 3 phase, 4 wire		
6 1 pole circuit, 15 amp		
2 2 pole circuit, 20 to 50 amp		
2 3 pole circuit, 15 to 30 amp		225.00
(Required for air conditioning system)		
INSTALL LIGHT FIXTURES (Fixtures Purchased on Allowance)		
Incandescent	Each	4.00
Fluorescent	Each	5.00
Yard light	Each	5.00
Bathroom exhaust fan	Each	50.00
Garden pedestal light fixture	Each	40.00

Commercial Wiring—Conduit

FLEXIBLE METALLIC	Per C
½"	32.50-36.00
¾"	37.50-43.50
1"	63.00-69.00

RIGID GALVANIZED	Per C
½"	49.00- 54.00
¾"	62.00- 68.00
1"	79.50- 87.00
1¼"	103.00-115.00
1½"	121.50-132.00
2"	160.00-175.00
2½"	229.00-252.00
3"	298.50-325.00
3½"	365.50-401.00
4"	417.50-456.00
5"	624.50-685.00

Commercial Wiring—EMT

	Per C
½"	34.50- 38.00
¾"	43.50- 48.00
1"	58.00- 64.00
1¼"	83.00- 90.00
1½"	70.50- 76.00
2"	103.00-112.00

Commercial Wiring—RHW

WIRE 600 V—75°	Per M
750 mcm, stranded	2,011.00-2,090.00
700 mcm, stranded	1,867.00-1,940.00
600 mcm, stranded	1,675.00-1,742.00
500 mcm, stranded	1,401.00-1,457.00
400 mcm, stranded	1,140.00-1,185.00
300 mcm, stranded	923.00- 960.00
250 mcm, stranded	830.00- 860.00
No. 4/0, stranded	690.00- 717.00
No. 3/0, stranded	567.00- 589.00
No. 2/0, stranded	451.00- 965.00
No. 1/0, stranded	378.50- 393.00
No. 1, stranded	322.50- 335.00
No. 2, stranded	240.00- 249.00
No. 4, stranded	182.50- 190.00
No. 6, stranded	137.00- 142.00
No. 8, stranded	106.50- 110.00
No. 10, stranded	80.50- 83.00
No. 12, stranded	66.00- 68.00
No. 14, stranded	57.00- 59.00
No. 8, solid	99.00- 102.00
No. 10, solid	75.00- 78.00
No. 12, solid	61.00- 63.00
No. 14, solid	52.50- 54.00

Commercial Wiring—TW

WIRE 600 V—75°	Per M
750 mcm, stranded	1,850.00-1,924.00
600 mcm, stranded	1,537.00-1,598.00
500 mcm, stranded	1,300.00-1,350.00
400 mcm, stranded	1,017.00-1,057.00
300 mcm, stranded	850.00- 882.00
250 mcm, stranded	750.00- 780.00
No. 4/0, stranded	635.50- 660.00
No. 3/0, stranded	543.00- 564.00
No. 2/0, stranded	432.50- 449.00
No. 1/0, stranded	356.50- 370.00
No. 1, stranded	306.00- 318.00
No. 2, stranded	227.00- 236.00
No. 4, stranded	173.00- 179.00
No. 6, stranded	129.50- 134.00
No. 8, stranded	95.00- 98.00
No. 10, stranded	73.00- 75.00
No. 12, stranded	59.50- 61.00
No. 14, stranded	51.50- 53.00
No. 8, solid	87.00- 90.00
No. 10, solid	68.00- 70.00
No. 12, solid	55.00- 57.00
No. 14, solid	47.50- 49.00

Commercial—Outlets & Connections

Conduit and wire not included	Each
Light fixture outlet	
Recess	8.00
Surface	7.00
WP	8.00
Duplex outlet	
15 amp	9.00
15 amp WP	10.00
Clock outlet	9.00
Floor outlet, flush	17.00
Floor outlet, pedestal type	23.00
Outlet, 240 v, 3 wire, 1 phase, 30 to 50 amp	13.00
Outlet, 240 v, 4 wire, 3 phase, 30 to 50 amp	16.00
Switch, single pole	9.00
Switch, double pole	10.00
Switch, 3 way	10.00
Switch, single pole w/pilot	12.00
Switch, momentary contact	10.00

Motor Outlet & Connection

GREENFIELD FLEXIBLE CONDUIT	Each
Fractional hp, 120 v, 1 phase	11.00
Fractional to 3 hp, 240 v, 3 phase	13.00
5 to 10 hp, 240 v, 3 phase	14.50
15 to 25 hp, 240 v, 3 phase	18.00
30 to 50 hp., 240 v, 3 phase	26.50
60 to 100 hp, 480 v, 3 phase	35.00
For Sealtite add 25%	
For explosionproof add 50%	

Power & Control Equipment

MOTOR DISC. SWITCH TYPE C NONFUSIBLE STD. DUTY 250 V	Each
30 amp, 2 pole, 240 v	19.00
30 amp, 3 pole, 240 v	21.50
60 amp, 3 pole, 240 v	34.00
100 amp, 3 pole, 240 v	52.00
200 amp, 3 pole, 240 v	84.50
400 amp, 3 pole, 240 v	178.00
600 amp, 3 pole, 240 v	280.00
30 amp, 3 pole, 575 v	22.00
60 amp, 3 pole, 575 v	36.00
100 amp, 3 pole, 575 v	54.00
200 amp, 3 pole, 575 v	88.00
400 amp, 3 pole, 575 v	184.00
600 amp, 3 pole, 575 v	290.00
PUSHBUTTON STATION	
NEMA 1, std. duty	
One button	14.50
Two button	17.00
Three button	22.50
NEMA 1, heavy duty	
One button	20.00
Two button	27.00
Three button	34.00
NEMA 4 & 5, std. duty	
One button	32.50
Two button	34.00
Three button	38.50
NEMA 4 & 5, heavy duty	
One button	37.50
Two button	42.50
Three button	61.00
MOTOR STARTERS—MANUAL	
Size 00—1 pole, 120/208 v	17.00
Size 00—2 pole, 240/480 v	19.00
Size 0—2 pole, 240/480 v	32.00
Size 1—2 pole, 240/480 v	37.00
Size 0—3 pole, 240/480 v	41.00
Size 1—3 pole, 240/480 v	46.00
MOTOR STARTERS—MAGNETIC RESET ONLY IN COVER	
Size 0—2 pole, single phase	47.00
Size 1—2 pole, single phase	52.00
Size 1½—2 pole, single phase	67.00
Size 0—3 pole, 3 phase	55.00
Size 1—3 pole, 3 phase	60.00
Size 2—3 pole, 3 phase	107.00
Size 3—3 pole, 3 phase	173.00
Size 4—3 pole, 3 phase	365.00
MOTOR STARTERS—MAGNETIC START, STOP, RESET IN COVER	
Size 0—2 pole, single phase	56.00
Size 1—2 pole, single phase	62.00
Size 1½—2 pole, single phase	77.00
Size 0—3 pole, 3 phase	63.00
Size 2—3 pole, 3 phase	68.00
Size 2—3 pole, 3 phase	116.00
Size 3—3 pole, 3 phase	183.00
Size 4—3 pole, 3 phase	374.00
UNDERFLOOR DUCT SYSTEM	
Duct, No. 2, single run, including junction boxes and misc. ftgs., etc. Per ft	2.90
Duct No 4, single run, including junction boxes and misc. ftgs, etc. Per ft	3.20
Pedestal underfloor duct outlet, power Each	16.50
Pedestal underfloor duct outlet, telephone Each	14.00

These prices are based on current labor rates in San Francisco. To modify for your area the following multipliers should be applied to the labor portion (your estimate) of the above figures.

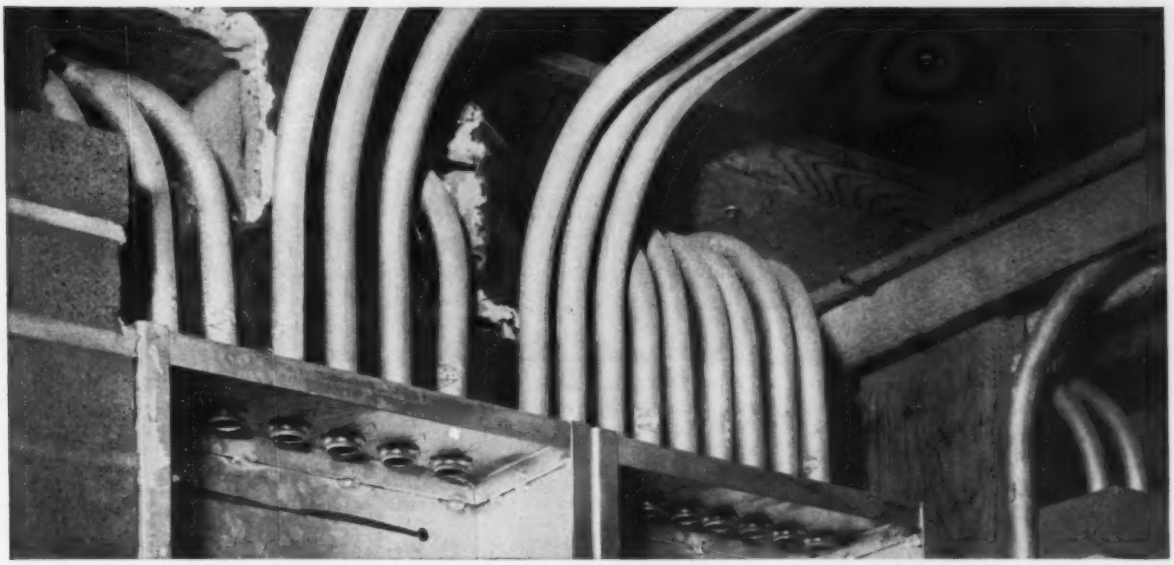
Using San Francisco as	1.00
Los Angeles	1.06
San Diego	1.05
Oregon	0.90
Western Washington	0.90
Eastern Washington	0.89
Idaho	0.82
Utah	0.85
Nevada	1.02
Arizona	0.96
New Mexico	0.86
Colorado	0.89
Wyoming	0.84
Montana	0.81

Houston, Texas, contractor says **REPUBLIC ELECTRUNITE E.M.T.**

ELECTRICAL METALLIC TUBING

makes neater installations at less cost

UNDER CONSTRUCTION
The Carousel Motel, Houston, Texas
Architect: William Tamminga
General Contractor: South Texas Building Company
Electrical Contractor: Todd Electric Company



FULL-LENGTH "GUIDE-LINES" make possible accurate, good-looking bends every time with ELECTRUNITE E.M.T.

Writes S. W. Todd, electrical contractor for Houston's beautiful new Carousel Motel:

"We find that SILVERSLICK® inside finish and the INSIDE-KNURLING® make wire pulling easier and the "INCH-MARKS"® make for easier bending. We find also that the "GUIDE-LINES"® the length of the tubing make it easier to make bends and saddles without getting them out of line.

"We will be pleased to recommend ELECTRUNITE to anyone who wishes to make neater installations at less cost."

See for yourself how Republic ELECTRUNITE E.M.T. can cut installation and wire pulling time, reduce waste, increase your profits. Get ELECTRUNITE from your electrical distributor. You, too, will find "the *best* costs *less* installed."

REPUBLIC STEEL

REPUBLIC HAS THE FEEL FOR MODERN STEEL

Compatibility and strength characterize raceways made of Galvanized Steel

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I would like more information about the installation savings of Republic ELECTRUNITE® E.M.T.

Name _____ Title _____

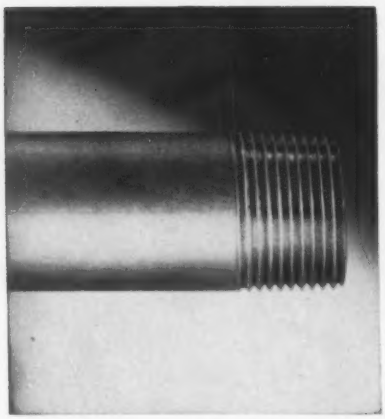
Firm _____

Address _____

City _____ Zone ____ State _____

For phone number of closest representative see advertising index in back of book.

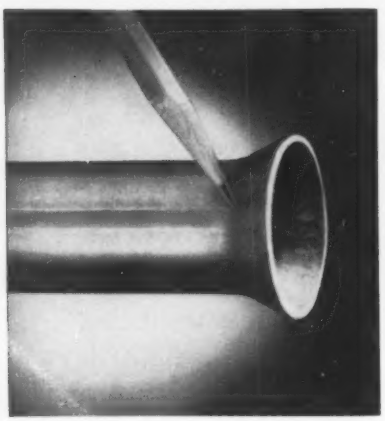
6 ways you benefit when you install ROME RIGID STEEL CONDUIT



EASY CONNECTING. Rome rigid steel conduit exclusively is **hot dip** zinc-coated by the Sendzimir process after threading. Threads are clean, sharp.

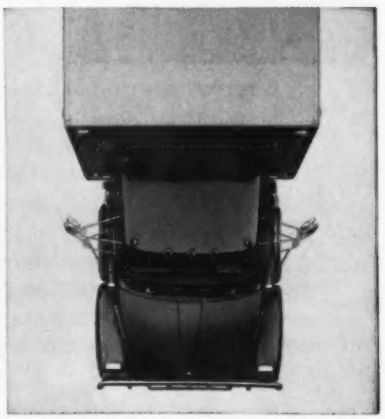
EASY BENDING. Uniformity of the conduit wall, due to **controlled annealing** before galvanizing, makes Rome conduit easy to bend accurately.

EASY SIZE IDENTIFICATION. Each length is identified by color-coded, size-imprinted thread protectors . . . and, in addition, the size is imprinted on the tube itself.



UNBREAKABLE WELD. Uniform edges, bonded by electrical resistance welding, form a weld stronger than the pipe itself.

EASY HANDLING. Conduit is shipped in one-ton bundles, subdivided into smaller bundles for easy handling on the job site.



CONVENIENT DELIVERY. Fast, efficient shipment to the job site from your nearby Rome Cable electrical distributor.

For more information on Rome rigid steel conduit, write for Bulletin RCP-940, or ask for a sample. Rome Cable Division of Alcoa, Dept. 4-71, Torrance, Calif.

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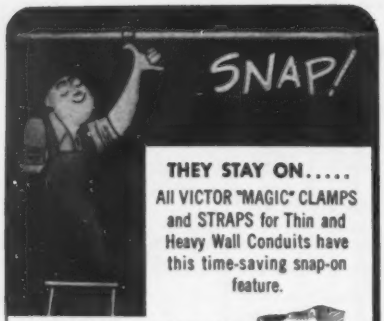

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